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SELECTED WATER RESOURCES ABSTRACTS

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JUNE 1983

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SELECTED WATER RESOURCES ABSTRACTS

A monthly publication of the Geological Survey
U.S. Department of the Interior

VOLUME 16, NUMBER 6
JUNE 1983

W83-01751 -- W83-02100

The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Directory of the Office of Management and Budget through September 30, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a monthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

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THE WATER RESOURCES SCIENTIFIC INFORMATION CENTER DOES NOT PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
U.S. Geological Survey, MS 421
Reston, VA 22092

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Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

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SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1B. Aqueous Solutions and Suspensions

ADSORPTION OF METAL IONS AND METAL COMPLEXES ON CLAY MINERALS: A STUDY OF THE NATURE OF BONDING BY X-RAY PHOTOELECTRON SPECTROSCOPY,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Chemistry.
J. G. Dillard, A. B. Emerson, M. H. Koppelman, D. L. Crowther, and C. V. Schenck.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-167882, Price codes: A10 in paper copy, A01 in microfiche. Virginia Water Resources Research Center, Blacksburg, Completion Report, September 1982. 148 p, 30 Fig, 31 Tab, 118 Ref. OWRT B-119-VA(1).

Descriptors: *Bonding, Metals, *Metal ions, Metal ion complexes, Oxidation, *Spectroscopy, *X-ray photoelectron spectroscopy, Electrochemistry, *Clay minerals, *Surface chemistry, Chemical analysis, Chemical properties, Adsorption, Solids contact processes, Physicochemical properties, *Electrophoresis, Solid surfaces, Lead, Cobalt, Kaolinite, Nickel, Copper.

Results are reported of an investigaton of the interaction of metal ions, metal ion complexes, and organic ligands with mineral and metal ion-saturated surfaces. Minerals studied include those with oxidizing and nonoxidizing surfaces (for example, lead, cobalt, kaolinite, nickel, copper), selected as being typical of those with which metal ions and organic-metal complexes would interact. The purpose was to provide detailed chemical descriptions of the nature of the surface species. Surface characterization includes x-ray photoelectron spectroscopy, electrophoretic mobility, and infrared and visible spectroscopy. Results describe the chemical oxidation state of the adsorbed metals, the chemical stoichiometry of the surface adsorbates, and the chemical nature of the adsorbed ions. Evidence indicates that metal complexes interact with clay mineral surfaces via dissociative hydrolytic process. On the other hand, metal ion and metal ion complexes are oxidized when adsorbed on the MnO_2 surface. Probable reactions processes for the dissociative hydrolytic processes are presented.
W83-02058

2. WATER CYCLE

2A. General

WASTEWATER SIMULATION MODEL FACES TOUGHEST TEST.
World Water, Vol 5, No 9, p 56-57, September, 1982. 1 Fig.

Descriptors: *Model studies, *Wastewater, *Simulation, Computers, SESIM, *Federal Republic of Germany, Hamburg, Pollutant identification, Water levels, Surface runoff, Hydrographs, Storms, Storm runoff.

A storm/wastewater management mode, SESIM, has been used to compute and simulate discharge in sewer systems since 1973 in Hamburg, Germany. SESIM is a hydrodynamic simulation model with an algorithm in the transport model which completely solves Barre de Saint Venant's equations for impulse and continuity. The first model, RUNOFF, covers the surfaces of urban areas such as roads, roofs, pavements and lawns, excluding backwater effects. The following hydrographs for each catchment area can be calculated: surface runoff as a result of a natural storm event or a storm model, dry weather flow, and hydrograph of pollution load. The hydrodynamic part of the drainage simulation is based on a configuration of junctions and branches, the junctions being manholes and the branches, pipes. Within the system, discharge is computed for a chosen time interval, and the following hydrographs are computed: water levels in a manhole, discharges, velocities, and concentrations of pollutants. (Baker-FRC)
W83-01840

DISTRIBUTED MODEL FOR SMALL SEMIARID WATERSHEDS,
Agricultural Research Service, Tucson, AZ. Southwest Watershed Research Center.
L. J. Lane.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 108, No HY10, p 1114-1131, October, 1982. 5 Fig, 3 Tab, 34 Ref.

Descriptors: *Semiarid lands, *Flood frequency, *Hydrographs, Rainfall-runoff relationships, Model studies, Runoff, Peak discharge, Ephemeral streams, *Watersheds, *Arizona, Kansas, Nebraska, Texas.

A model for estimating runoff volumes and peak rates of flow from small semiarid watersheds was developed and tested on data from watersheds in Arizona, Kansas, Nebraska, and Texas. It is a compromise between physically based deterministic models and simplified procedures. The completed model was tested on data from 10 experimental watersheds in Arizona, representing over 260 rainfall-runoff events. Model results agreed well with observed results. It can also be used to predict water yield to a surface water balance incorporating transmission losses in ephemeral stream channels. Input parameters were obtained from maps, field measurements, handbooks, and other sources. Sensitivity of peak discharge for mean annual flood was significant for runoff curve number and rainfall depth, moderate to significant for watershed geometry, and moderate for channel geometry, hydraulic conductivity, and hydrograph shape parameters. (Cassar-FRC)
W83-01920

PHYSICAL CONSIDERATIONS IN THE ANALYSIS AND SYNTHESIS OF HYDROLOGIC SEQUENCES,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2B.
W83-01956

A DESIGN-DISCHARGE CALCULATION METHOD BASED ON THE PARALLEL USE OF RESERVOIR MODELS,
Louvain Univ. (Belgium). Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 4A.
W83-02017

HYDROLOGIC SERIES GENERATION FROM THE SPECTRAL DENSITY FUNCTION,
Utah Water Research Lab., Logan.
R. V. Canfield.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-167981, Price codes: A03 in paper copy, A01 in microfiche. Utah Water Research Laboratory Hydraulic and Hydrology Series H-82/04, November 1982. 27 p, 8 Fig, 11 Tab, 11 Ref. OWRT A-054-UTAH(1), 14-34-0001-2147.

Descriptors: *Water supply, *Stochastic hydrology, Spectral density, *Autocorrelation, *Correlation structure, Frequency domain, Simulation, *Time series analysis, *Error analysis, Fortran language, Computer programs, Monte Carlo method.

Computer simulation of hydrologic sequences is an effective tool for estimating water yield. Present method of generating sequences have practical limits in their ability to preserve an observed autocorrelation structure. Bcause of the correspondence between the spectral density function and the autocorrelation function of a time series, the spectrum can be used to fit empirical autocorrelation structures observed in hydrologic sequences. The problem of maintaining observed correlation structure is reduced to the much easier problem of maintaining observed spectral characteristics. The series are generated in the frequency domain. The fast Fourier transform is then used to transform into the sequential domain of the process. When generating sequences from the spectrum, aliasing distorts the correlation function of the series. Direction in the choice of design parameters to eliminate the problem is given. A FORTRAN language program is provided to generate a sequence with a given spectral density function. Bias in the estimate of autocorrelation complicates the generation of sequences. If the observed autocorrelation has been estimated with bias, the associated Monte Carlo model can lead to erroneous conclusions. A method of unbiased estimation is developed and tested.
W83-02068

2B. Precipitation

AN ANALYTICAL STUDY OF SEVERE FLOODS OF JULY 1978 IN BAGMATI AND ADHWARA GROUPS OF RIVERS,
Flood Meteorological Office, Patna (India).
For primary bibliographic entry see Field 2E.
W83-01828

FLOOD METEOROLOGY OF GANGA BASIN IN BIHAR: A SYNOPTIC ANALOGUE STUDY,
Flood Meteorological Office, Patna (India).
K. Prasad, and A. K. Sen Sarma.
Mausam, Vol 32, No 4, p 415-424, October, 1981. 9 Fig, 2 Tab, 2 Ref.

Descriptors: *Floods, *Forecasting, *Meteorological data collections, Flood control, Ganga basin, Bihar, Rainfall, Storms, *India.

A detailed survey was made from available records of all past synoptic situations which resulted in heavy rainfall in different subcatchments of the Ganga basin in Bihar in different months of the monsoon season. Most of these spells are associated with either a low pressure system or a break monsoon condition. While the heavy rain associated with the break condition is confined to the immediate vicinity of the monsoon trough, effects of a low pressure system extend far beyond its location. It has been possible to delineate an area for each month and each individual subcatchment, location of a low pressure system within which is fraught with a risk of heavy rainfall in that particular subcatchment. This area has been termed as the risk zone for the subcatchment. (Baker-FRC)
W83-01829

PHYSICAL CONSIDERATIONS IN THE ANALYSIS AND SYNTHESIS OF HYDROLOGIC SEQUENCES,
Washington Univ., Seattle. Dept. of Civil Engineering.
K. M. Leytham.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-167593, Price codes: A12 in paper copy, A01 in microfiche. Technical Report No 76, University of Washington, Seattle, June 1982. 237 p, 65 Fig, 29 Tab, 88 Ref. OWRT A-107-WA(1) and A-115-WA(1), 14-34-0001-1151.

Descriptors: *Drought, Hydrology, *Univariate mixture models, *Precipitation, *Atmospheric nonlinearities, *Model studies, *British Columbia, Precipitation data, Classification, Rainfall distribution.

An investigation of univariate mixture models was undertaken including a study of the small sample properties of maximum likelihood parameter estimates for a mixture of two normal distributions. This study showed that while the parameters estimated from small unclassified samples are unreliable, the estimated quantiles compare favorably with those estimated using classified data. Thus the ability to classify data from a mixture distribution is not necessarily important for hydrologic applications. Analysis of long rainfall records from southern British Columbia showed that while mixture distributions fitted the data well, they are too complex to be justified for single-site precipitation modeling. The use of multi-variate mixture distributions for multi-site precipitation modeling was

explored. Such models are capable of preserving the marginal distributions and cross correlation structure of data which could not be modeled adequately using conventional models. Multi-variate mixture models also allow explicit recognition of the widespread nature of drought.
W83-01956

SOME RAINFALL FEATURES OF JULY 1979 STORM OVER LUNI BASIN,
Central Arid Zone Research Inst., Jodhpur (India).
K. D. Sharma, and N. S. Vangani.
Annals of Arid Zone, Vol 21, No 1, p 29-39, March, 1982. 7 Fig, 2 Tab, 5 Ref.

Descriptors: *Rainfall, *Storms, *Maps, Isohyetal maps, Isohyets, Precipitation, Storm events, Arid zone, Luni Basin, *India.

The rainfall features of the July 1979 storm over Luni Basin are reported. From the isohyetal maps drawn for these days it is noted that there had been three maxima of rainfall in the isohyetal pattern of 15 July. Rainfalls on the order of 10-100 mm were widespread in the Upper Luni Basin, with practically no rain in central and lower Luni basins. On 16 July the rainfall was spread over the entire Luni basin; the heaviest rain, exceeding 300 mm, occurred over Rundia and Padasla Kalan in Upper Luni catchment. The storm was more severe on 17 July, when the entire Luni Basin received rainfall exceeding 50 mm. On 18 July the storm shifted south-westward, and a maximum of 250 mm rain was recorded over Jadan, Padasla Kalan and Rundia in Guhiya and Bandi B catchments. Although the storm had weakened in the lower Luni Basin, the upper and central Luni basins had recorded rainfall on the order of 100-200 mm. By 19 July the storm had almost withdrawn from the Luni basin, except that the Upper Luni still received rain in localized spots. Depth-area-duration analysis of this storm was carried out for durations of 1, 2, 3, 4, and 5 days for each sub-catchment of Luni basin area. All of the studies indicated that the rainstorm of 15-19 July 1979 was one of the most severe and the water volume generated was much larger than that obtained in any rainstorm over this region in the past. (Baker-FRC)
W83-02002

2C. Snow, Ice, and Frost

SHALLOW FOUNDATIONS IN COLD REGIONS: DESIGN,
Hardy Associates Ltd., Edmonton (Alberta).
For primary bibliographic entry see Field 8D.
W83-01931

CONTRIBUTION OF SNOWMELT TO THE OCTOBER 1978 FLOOD OF THE POMAHAKA AND FRASER RIVERS, OTAGO,
Otago Univ., Dunedin (New Zealand).
B. B. Fitzharris, D. Stewart, and W. Harrison.
Journal of Hydrology (New Zealand), Vol 19, No 2, p 84-93, 1980. 4 Fig, 2 Tab, 8 Ref.

Descriptors: *Snowmelt, *Floods, *Estimating, Snow cover, Snowpack, Snowline, Floodwater, *New Zealand, Catchments, Rivers, Fraser River, Pomahaka River.

In three days the rapid melt of a Central Otago mountain snowpack produced 97 mm of water, which was added to the 150 mm of rainfall produced by the same storm. The energy sources for the melt were dominated by convective fluxes. The contribution of snowmelt to the major October flood of 1978 was over one-third of the flow of the Fraser River, but less than 10% of the flow of the Pomahaka River. An estimated 58% of the energy for melt may have come from turbulent transfer of sensible and latent heat to the snowpack surface. Mild, moist northwest airflows often occur in spring storms, suggesting that similar, rapid melting of the spring snowpack may be common on Otago mountains. Estimates of the heat balance suggest that there is substantial energy available from turbulent transfer of heat and water vapor to the snow surface during these warm, windy conditions. Therefore other floods, including the one in 1978, may have had an important snowmelt component from the high elevation catchments. In lower catchments the contribution of snowmelt to flooding is not important, as the area above the snowline is too small. (Baker-FRC)
W83-01988

A METHOD FOR PREDICTING WINTER OXYGEN PROFILES IN ICE-COVERED ONTARIO LAKES,
Ontario Ministry of the Environment, Rexdale. Limnology and Taxonomy Section.
For primary bibliographic entry see Field 2H.
W83-02099

2D. Evaporation and Transpiration

POTENTIAL OF DRIP IRRIGATION IN ROW CROPS FOR AGRICULTURE WATER CONSERVATION IN CALIFORNIA,
California Univ., Davis. Dept. of Land, Air and Water Resources.
For primary bibliographic entry see Field 3F.
W83-01954

WATERBORNE NUTRIENT FLOW THROUGHAN UPLAND-PEATLAND WATERSHED IN MINNESOTA,
North Central Forest Experiment Station, Grand Rapids, MN. Forestry Sciences Lab.
E. S. Verry, and D. R. Timmons.
Ecology, Vol 63, No 5, p 1456-1467, 1982. 4 Fig, 9 Tab, 34 Ref.

Descriptors: *Nutrients, *Watersheds, Phosphorus, Calcium, Potassium, Magnesium, Sodium, *Minnesota, Evapotranspiration, Hydrology, Marcell Experimental Forest, Forest watersheds.

Water and nutrient flow were measured on a complex upland peatland watershed in north central Minnesota. Annual water budgets for upland and peatland components and for the total watershed were developed. Nutrient input and output budgets were developed for each component on a seasonal basis, using net precipitation inputs, and an annual nutrient budget was developed for the entire watershed, using gross precipitation and total outputs. Both components evapotranspire water near potential rates. The upland converts 34% of the water input to water yield, while the peatland converts 55% of its water input to water yield. The upland annually retains some N, P, K, and Ca from net precipitation, but passes through Mg and supplies Na in excess of inputs. The peatland is a nutrient trap retaining 36-60% of all nutrient inputs annually. There are striking differences in the seasonal retention of nutrient forms between the upland and bog. The total watershed accumulates P and N but loses more K, Ca, Mg, and Na than it receives in gross precipitation. Nutrient flow is interpreted for the design of nutrient-added technologies and as a bench mark for nutrient-depleted technology. (Baker-FRC)
W83-02089

2E. Streamflow and Runoff

PLOTTING POSITIONS OF ANNUAL FLOOD EXTREMES CONSIDERING EXTRAORDINARY VALUES,
Chengdu Univ. of Science and Technology (China). Dept. of Hydraulic Engineering.
Y. Zhang.
Water Resources Research, Vol 18, No 4, p 859-864, August 1982, 5 Fig, 1 Tab, 22 Ref.

Descriptors: *Flood recurrence interval, *Frequency analysis, *Annual floods, *Mississippi River, Flood frequency, *Plotting positions, Statistical analysis, *Iowa, Keokuk, Weibull formula, Probability distribution, Historic floods.

A generalized plotting position formula was derived for estimating the flood recurrence interval or its recipropcal, the exceedance probability, for a data sample containing extraordinarily large and small values. The derivation was based on order statistics analysis and was independent of the probability distribution of the hydrologic variable. The Weibull formula was found to be a special case of the general formula. An example, using flood data on the Mississippi River at Keokuk, Iowa, dating back to 1851, illustrated the use of the formula. A 24-year (1878-1901) record plus two extremely large floods (360,000 cu ft per sec in 1851 and 344,000 cu ft per sec in 1973) and a small flood (52,500 cu ft per sec in 1930) were used to create plotting positions. (Cassar-FRC)
W83-01758

RUNS CHARACTERISTICS OF STREAMFLOWS,
Asian Inst. of Tech., Bangkok (Thailand).
H. N. Phien, and H. K. M. Vithana.
Water S A, Vol 8, No 3, p 130-137, July, 1982. 2 Fig, 5 Tab, 21 Ref.

Descriptors: *Streamflow, *Runs characteristics, *Hydrologic data, *Model studies, Drought, Mathematical studies, Statistics, *Runs theory, Data collections, *Monthly streamflows.

The theory of runs was used to analyze hydrological data (35-102 year streamflow records from 8 stations in 5 countries) with regard to wet and drought indicators. The effect of skewness and dependence of annual flows on the runs characteristics (wet and drought periods, positive and negative run sums) was studied. A model for generating monthly streamflows was developed. It reproduced the runs characteristics of observed monthly streamflows. (Cassar-FRC)
W83-01804

AN ANALYTICAL STUDY OF SEVERE FLOODS OF JULY 1978 IN BAGMATI AND ADHWARA GROUPS OF RIVERS,
Flood Meteorological Office, Patna (India).
A. K. Chaudhury, P. Prasad, and K. Prasad.
Mausam, Vol 32, No 4, p 405-410, October, 1981. 9 Fig, 2 Tab, 2 Ref.

Descriptors: *Floods, *Rainfall, *Frequency analysis, Bihar, Rivers, Topography, *Storms, *India, Adhwara, Bagnati.

Synoptic and hydrometeorological aspects of severe floods that affected the Bagmati and Adhwara groups of rivers in north Bihar in July 1978 have been studied. The findings revealed that with much lower rainfall amounts, less favorable antecedent conditions and lower initial gauge levels, the flood peaks in the downstream reaches of the rivers were higher in 1978 than in 1975. Bagmati nearly reached the 1975 highest flood level (HFL) at the upstream site, Dheng, with only one-day rainfall in 1978, compared to four-day rainfall in 1975. The high intensity of short duration rainfall in the 1978 flood spell contributed significantly to the rivers' registering higher gauge rises and overtopping the 1975 HFL at the downstream sites in spite of the total storm rainfall yield and other factors being less favorable. The study emphasized the importance of short duration rainfall intensity in formulation of flood forecasts for smaller catchments. The superimposition of a minor wave disturbance in the lower tropospheric wind flow on prevailing break conditions seems to favor enhancement of rainfall activity in the wave disturbance. (Baker-FRC)
W83-01828

FLOOD FREQUENCY ANALYSIS FOR REGULATED RIVERS,
S. G. Buchberger.
Transportation Research Record, Vol 832, p 12-21, 1981. 9 Fig, 7 Tab, 15 Ref.

Descriptors: *Case studies, *River flow, *Watershed management, *Flood peak, *Flood frequency, *Statistical methods, *Time series analysis, Mathematical studies, Stochastic process, Reservoir operation, Water sheds, Regulated flow, *Colorado, Colorado River.

A case study of the Colorado River at Glenwood Springs, Colorado, is examined to show several

statistical tests identifying watersheds having changing conditions with time. Results show that annual peak flows of the Colorado River are influenced significantly by reservoir regulation, making conventional methods of frequency analysis inadequate for obtaining flood estimates. When conventional methods are not suitable, time-series analysis is a versatile approach to flood frequency determinations. In time-series analysis each value of the regulated annual peak-flow series is treated as a combination of two elements - a deterministic component and a stochastic component. The deterministic factor is quantified and removed from the flood series, while the stochastic components which are stationary and independent are fitted to a probability distribution from which annual floods are estimated. Time-series analysis gives 2% and 1% chance flood values (required for Interstate Highway design) that are substantially less than corresponding log-Pearson type III estimates. The resulting flood frequency estimates are more representative of the watershed due to the ability of time-series analysis to detect and treat the impact of reservoir regulation on the peak-flow series. (Geiger-FRC)
W83-01833

ESTIMATING THE MAGNITUDE OF PEAK DISCHARGES FOR SELECTED FLOOD FREQUENCIES ON SMALL STREAMS IN SOUTH CAROLINA (1975),
Geological Survey, Columbia, SC. Water Resources Div.
B. H. Whetstone.
Available from OFSS, USGS Box 25425, Fed Ctr, Denver, CO 80225. Paper copy $2.00, Microfiche $3.50. Geological Survey Open-File Report 82-337, 1982. 13 p, 1 Fig, 2 Tab, 8 Ref.

Descriptors: *Estimating, *Flood peak, *Flood frequency, *Small watersheds, Streams, Flood recurrence interval, Gaging stations, Flood data, Regression analysis, South Carolina.

A program to collect and analyze flood data from small streams in South Carolina was conducted from 1967-75, as a cooperative research project with the South Carolina Department of Highways and Public Transportation and the Federal Highway Administration. As a result of that program, a technique is presented for estimating the magnitude and frequency of floods on small streams in South Carolina with drainage areas ranging in size from 1 to 500 square miles. Peak-discharge data from 74 stream-gaging stations (25 small streams were synthesized, whereas 49 stations had long-term records) were used in multiple regression procedures to obtain equations for estimating magnitude of floods having recurrence intervals of 10, 25, 50, and 100 years on small natural streams. The significant independent variable was drainage area. Equations were developed for the three physiographic provinces of South Carolina (Coastal Plain, Piedmont, and Blue Ridge) and can be used for estimating floods on small streams. (USGS)
W83-01853

AT-A-STATION HYDRAULIC GEOMETRY OF THE PLATTE RIVER IN SOUTH-CENTRAL NEBRASKA,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 7A.
W83-01856

COST EFFECTIVE STREAM-GAGING STRATEGIES FOR MAINE,
Geological Survey, Augusta, ME. Water Resources Div.
For primary bibliographic entry see Field 7A.
W83-01857

FLOODS OF MAY 1981 IN WEST-CENTRAL MONTANA,
Geological Survey, Helena, MT. Water Resources Div.
C. Parrett, R. J. Omang, J. A. Hull, and J. W. Fassler.
Geological Survey Water-Resources Investigations 82-33, June 1982. 20 p, 9 Fig, 2 Tab, 4 Ref.

Descriptors: *Floods, *Flood peak, *Flood discharge, *Flood frequency, Rainstorms, Flood damage, Streamflow, Sediments, Data collections, Flood hydrographs, *Montana, Clark Fork basin, Missouri River basin.

Extensive flooding occurred in west-central Montana during May 22-23, 1981, as a result of a series of rainstorms. Flooding was particularly severe in the communities of East Helena, Belt, and Deer Lodge. Although no lives were lost, total flood damages were estimated by the Montana Disaster Emergency Services Division to be in excess of $30 million. Peak discharges were determined at 75 sites in the flooded area. At 25 sites the May 1981 peak discharge exceeded the computed 100-year frequency flood, and at 29 sites, where previous flow records are available, the May 1981 peak discharge exceeded the previous peak of record. (USGS)
W83-01861

ENVELOPE CURVES FOR EXTREME FLOOD EVENTS,
Geological Survey, Menlo Park, CA.
J. R. Crippen.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 108, No HY10, p 1208-1212, October, 1982. 2 Fig, 2 Tab, 4 Ref.

Descriptors: *Flood forecasting, *Drainage area, Historic floods, Graphical analysis, Basins.

Maximum flood experience in a region can be depicted by a graph on which maximum known floods are plotted against drainage area. Envelope curves, described by equations, are developed for 17 regions in the U.S. Since most of the data is from large or medium basins, an envelope curve for maximum floods nationwide is not appropriate without including factors in addition to basin area. The curves do not indicate flood probability or frequency. However, a large flood in one location in the region may be approached or equaled at other basins in the same region. The curves cannot be used for specific engineering applications, only for rule-of-thumb estimates of potential flood risk. (Cassar-FRC)
W83-01919

SIMPLIFIED TESTING OF HYDROLOGIC REGRESSION REGIONS,
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 7C.
W83-01922

BED MATERIAL SORTING IN POOLS AND RIFFLES,
Illinois State Water Survey Div., Champaign.
For primary bibliographic entry see Field 2J.
W83-01925

NUMERICALLY COMPUTED MULTIPLE STEADY STATES OF VERTICAL BUOYANCY-INDUCED FLOWS IN COLD PURE WATER,
State Univ. of New York at Buffalo, Amherst. Dept. of Mathematics.
For primary bibliographic entry see Field 8B.
W83-01989

ON THE STRUCTURE OF TURBULENT CHANNEL FLOW,
Royal Inst. of Tech., Stockholm (Sweden). Dept. of Mechanics.
For primary bibliographic entry see Field 8B.
W83-01990

BOUYANCY-DRIVEN CIRCULATION IN FREE-SURFACE CHANNELS,
Iowa Univ., Iowa City. Inst. of Hydraulic Research.
For primary bibliographic entry see Field 8B.
W83-01991

DYNAMIC WATER ROUTING UTILIZING A PREDICTOR-CORRECTOR METHOD WITH SEDIMENT ROUTING,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
D. B. Simons, R. M. Li, J. Garrecht, and R. K. Simons.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-168021, Price codes: A07 in paper copy, A01 in microfiche. Colorado Water Resources Research Institute Completion Report No 117, Fort Collins, September 1982. 145 p, 12 Fig, 5 Tab, 30 Ref, 4 Append. OWRT B-228-COLO(1), 14-34-0001-1212.

Descriptors: *Flood Routing, *Flood Waves, *Unsteady Flow, Dynamic Water Routing, Sediment Routing, Salt River, *Arizona, *St. Venant aquations, Model studies, Prediction-corrector method.

A stable and efficient dynamic water routing method is presented which overcomes the difficulties of many numerical models by introducing physical concepts into the finite difference solution technique. Stability restrictions or complexity of the explicit and implicit schemes are overcome without reverting to simplifications of the complete St. Venant equations, but by controlling the flood wave movement in space and time with the nonlinear wave celerity. Simplicity and efficiency in the solution technique is attained by solving the governing equations in an uncoupled manner with a predictor-corrector method. The use of a predictor-corrector method inhibits the growth of error by reconsidering and readjusting the predicted values in the corrector step. The model was successfully applied to a general case which included computation of bed elevation changes based on sediment routing by sizing fraction. The completeness and efficiency of the dynamic water routing model DYNWAR makes it particularly interesting for general studies of large river systems with mild and steep channel improvements where the backwater and dynamic effects are relevant and also for sediment routing to evaluate bed elevation changes.
W83-02072

2F. Groundwater

GROUND WATER QUALITY IN SOUTHEASTERN MINNESOTA,
Minnesota Univ., Minneapolis. School of Public Health.
For primary bibliographic entry see Field 5B.
W83-01791

RECOVERY IN LARGE DIAMETER WELLS,
Center for Water Resources Development and Management, Calicut (India). Ground Water Div.
For primary bibliographic entry see Field 8B.
W83-01924

ASSESSMENT OF FRACTURE-TRACE MAPPING AS A GROUNDWATER PROSPECTING TOOL IN THE METAMORPHIC TERRANE SURROUNDING FAIRBANKS, ALASKA,
Alaska Univ., Fairbanks. Inst. of Water Resources.
For primary bibliographic entry see Field 4B.
W83-02060

PREDICTING THE SPECIFIC CAPACITIES OF WELLS PENETRATING THE OCALA AQUIFER BENEATH THE DOUGHERTY PLAIN, SOUTHWEST GEORGIA,
Georgia Univ., Athens. Dept. of Geography.
G. A. Brook, and C-H. Sun.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-167965, Price codes: A05 in paper copy, A01 in microfiche. Georgia Institute of Technology, Atlanta, Environmental Resources Center, Report Number ERC 09-82, September 1982, 86 p, 19 Fig, 24 Tab, 22 Ref. OWRT A-086-GA(1), 14-34-0001-0111.

Descriptors: *Fractures, *Fractures traces, *Groundwater, *Hydrogeology, *Karst, Lineaments, Sink holes, *Sinks, *Specific capacity,

*Wells, Well productivity, *Georgia, Dougherty Plain, Ocala Aquifer.

Within the Dougherty Plain region of Georgia, well specific capacities in gpm/ft are significantly higher when wells are located within a zone extending for 97 feet on either side of a fracture trace. The mean specific capacity of 18 fracture trace wells (i.e. within 97 feet of a fracture trace) examined was 435 gpm/ft; the mean of 21 nonfracture trace wells was 85 gpm/ft. The model recommended for use in predicting fracture trace well specific capacity is: Log sub e (SPECA) = 5.75-0.0129 (DISTL) + 0.0144 (INTNO) + 0.00015 (CLOLEN), where SPECA is specific capacity in gpm/ft, DISTL is the distance in feet from the well to the nearest fracture trace, INTNO is the number of fracture trace intersections per mi super 2 in the area around the well, and CLOLEN is the length in feet of the fracture trace on which the well is located. This model explains 77% of the variation in fracture trace well specific capacity. The model recommended for use in predicting nonfracture trace well specific capacity is: Log sub e (SPECA) = 5.75.0.0033 (DISTL 2), where DISTL 2 is equal to DISTL or DISIK (the distance in feet from the well to the center of the closest fracture trace) whichever is smaller. This model explains 82% of the variance in nonfracture trace well specific capacity.
W83-02066

2G. Water In Soils

WATER CONDUCTION IN HAWAII OXIC SOILS,
Hawaii Univ. at Manoa, Honolulu. Water Resources Research Center.
R. E. Green, L. R. Ahuja, S-K. Chong, and L. S. Lau.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-154401, Price codes: A07 in paper copy, A01 in microfiche. Technical Report No 143, August 1982. 132 p, 33 Fig, 30 Tab, 48 Ref, 4 Append. OWRT B-048-HI(1), B-054-HI(6), 14-34-0001-7026, -7116, 14-34-0001-7116, -8075.

Descriptors: *Soil water movement, *Soil water storage, *Hydraulic conductivity, *Unsaturated soils, Drainage, Infiltration, *Hawaii, *Oaha, Soil surveys, *Oxisols, Green-Ampt model, Wahiawa plateau, Waikele watershed.

Oxic soils on Oaha were studied to develop and test simplified methods of determining the hydraulic conductivity of unsaturated soils, to test some simple infiltration models, and to assess the utility of soil survey mapped units in defining hydrologically similar soils. Field measurements of water infiltration and redistribution were accomplished on 21 sites located on the Lahaina, Molokai, and Wahiawa soil series. Water retention curves measured on undisturbed soil cores from the Ap1, Ap2, and B horizons of each site provided a means of determining the downward flux of water during redistribution from soil water suction measurements over time. These data allowed calculation of hydraulic conductivities (by a detailed Darcy analysis) of soil at various depths in the soil profile and for a range of water contents and suctions. The detailed analysis and field infiltration data provided a means of evaluating two new simplified methods of determining hydraulic conductivity functions of well-drained soils; the new methods are sufficiently accurate and economical to be used in watershed characterization. Also, field measured sorptivity and water redistribution data were used to successfully predict cumulative infiltration with the Talsma-Parlange and Green-Ampt equations, respectively. Statistical analysis of field and laboratory data suggested that soil maps of central Oaha would not be particularly useful in delineating soil areas of ralative homogeneity with respect to hydrologic properties. These results further empahsize the need for simple methods to characterize hydrologic properties of importance.
W83-01794

WASTEWATER TREATMENT IN SOIL AS A FUNCTION OF RESIDENCE TIME IN THE ROOT ZONE,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5D.
W83-01950

NITRIFICATION, DENITRIFICATION, AND SORPTION-DESORPTION OF NH SUB 4-N IN SANDS DURING WATER MOVEMENT TO SUBSURFACE DRAINS,
Florida Univ., Gainesville. Dept. of Soil Science.
For primary bibliographic entry see Field 5B.
W83-01955

THE DESIGN AND APPLICATION OF VERTICAL DRAINS,
For primary bibliographic entry see Field 8D.
W83-02094

2H. Lakes

METALIMNETIC OXYGEN DEPLETION IN LAKE MEAD AS IT RELATES TO THE LIMNETIC ZOOPLANKTON COMMUNITY,
Nevada Univ., Las Vegas. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5C.
W83-01789

DISTRIBUTION OF OLIGOCARBOPHILIC AND SAPROPHYTIC BACTERIA IN LAKE PLUSSSEE (VERTEILUNG DER OLIGOCARBOPHILEN UND SAPROPHYTISCHEN BAKTERIEN IM PLUSSSEE),
Max-Planck-Inst. fuer Limnologie zu Ploen (Germany, F.R.).
K. Moaledj, and J. Overbeck.
Archiv fur Hydrobiologie, Vol 93, No 3, p 287-302, February, 1982. 8 Fig, 41 Ref. English Summary.

Descriptors: *Limnology, *Bacteria, *Annual distribution, *Saprophytic bacteria, *Oligocarbophilic bacteria, Bacterial analysis, Water analysis, *Eutrophic lakes, *Federal Republic of Germany, Lake Plusssee, Culture media, Seasonal variation.

The annual distribution of oligocarbophilic and saprophytic bacteria was studied in the eutrophic Plusssee (Federal Republic of Germany) by cultivating bacteria taken from various lake depths (1, 5, 10, and 20 m) on various media. The number of oligocarbophilic bacteria, grown on mineral or diluted media, was higher than that of the saprophytic bacteria, grown on undiluted nutrient agar -- approximately twice as high in most cases. Through the use of media with different nutrient components, different groups from the total bacterial population could be studied in relation to the nutrient composition of the ecosystem. The CPS medium made available a large number of organic carbon sources and inorganic components, favoring the growth of the largest number of taxonomic groups of bacteria. The seasonal vertical distribution of oligocarbophilic bacteria and heterotrophic saprophytes was, with few exceptions, essentially the same at all depths tested. Both groups displayed a short, slight late-autumn (November/December) maximum, followed by a winter minimum until mid-April, when the summer maximum (which peaked in June) set in; after this, a minimum was in effect until November. The number of both groups of bacteria decreased with depth, presumably due to oxygen decrease and unfavorable temperature. When bacteria were cultivated on agar in an atmosphere free from organic carbon, fewer colonies were counted than in normal air. (Gish-FRC)
W83-01823

THE PHOSPHORUS CYCLE IN GERMISTON LAKE. III. SEASONAL PATTERNS IN THE ABSORPTION, TRANSLOCATION AND RELEASE OF PHOSPHORUS BY POTAMOGETON PECTINATUS L.,
Rand Afrikaans Univ., Johannesburg (South Africa). Research Group for Freshwater Biology.
J. F. Vermaak, J. H. Swanepoel, and H. J. Schoonbee.
Water SA, Vol 8, No 3, p 138-141, July, 1982. 3 Tab, 29 Ref.

Descriptors: *Phosphorus, *Seasonal variation, *Macrophytes, Absorption, *Potamogeton pectinatus, Germiston Lake, Nutrients, Aquatic plants, Rooted aquatic plants, Cycling nutrients, *South Africa.

Potamogeton pectinatus L. in the littoral zone of Germiston Lake acts as a phosphorus reservoir. Solutions containing P-32 as phosphate were applied either to the root compartment or to the shoot compartment to Potamogeton in experimental containers during each of the 4 seasons. Plants were kept under conditions simulating daylight incubation or night incubation. Shoot absorption was greater than root absorption in spring and winter; the reverse was true in summer and autumn. Shoots released more P per plant than roots. Both shoots and roots absorbed much more P than they released. Since plants do not discriminate between P-31 and P-32, activity was converted to P-31. The absorption of P-31 (in micrograms) per 24 hours by the plants (after adapting the light-dark periods to the standard day and night lengths of the respective seasons) were: spring, root 94 and shoot 1849; summer, root 1162 and shoot 578; autumn, root 13966 and shoot 1992; and sinter, root 91 and shoot 562. Releases of P-31 (in micrograms) were: spring, root 5 and shoot 21: summer, root 5 and shoot 15; autumn, root 5 and shoot 47: and winter, root 22 and shoot 110. (Cassar-FRC)
W83-01824

ATLAS OF THE SPAWNING AND NURSERY AREAS OF GREAT LAKES FISHES; VOLUME XIII, REPRODUCTIVE CHARACTERISTICS OF GREAT LAKES FISHES,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
For primary bibliographic entry see Field 7C.
W83-01883

ATLAS OF THE SPAWNING AND NURSERY AREAS OF GREAT LAKES FISHES; VOLUME XIV, LITERATURE CITED,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
For primary bibliographic entry see Field 10F.
W83-01884

PREDICTING PHOSPHORUS LEVELS IN A FUTURE RESERVOIR,
Syracuse Univ., NY. Dept. of Civil Engineering.
S. W. Effler, S. D. Field, J. V. DePinto, E. M. Owens, Jr, and J. S. Dobi.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No EE4, p 688-705, August, 1982. 8 Fig, 2 Tab, 44 Ref.

Descriptors: *Phosphorus, *Reservoir operation, *Flow augmentation, Reservoir releases, Delaware River, Eutrophic lakes, Mesotrophic lakes, Model studies, New Jersey, Trenton.

The concentrations of total phosphorus at spring turnover were predicted for a proposed flow-augmentation reservoir on the Delaware River. Hypothetical data sets for 1929-1970 were used in two dynamic models (Dillon-Rigler and Lorenzen) and a steady state model for a wide range of reservoir operations. The reservoir will have a 60 million cu m capacity, an area of 2.5 million sq m, and a mean depth of 23.1 m. Releases are planned when flows at Trenton, New Jersey, are in the 85-89 cu m per sec range. Total P will be highly dependent on hydraulic operation of the reservoir. Dynamic models proved more suitable than the steady state model for simulating the substantial annual variation in total P at spring turnover. Differences between the two types of models were especially large immediately following a sudden change in operation. Both dynamic models give similar predictions; response time of 4 years and a transition

phase of 6 years. However, the Lorenzen model is more appropriate for a system which receives infrequent high loadings, since it is sensitive to recent P concentrations in sediment and water column. The reservoir should be continuously eutrophic (over 0.02 mg per liter P), bordering on mesotrophy during years when no releases are made. (Cassar-FRC)
W83-01905

PERFORMANCE OF SOME EMPIRICAL PHOSPHORUS MODELS,
Washington State Univ., Pullman. Dept. of Civil and Environmental Engineering.
D. S. Mahamah, and S. K. Bhagat.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No 4, p 722-729, August, 1982. 2 Fig, 3 Tab, 12 Ref.

Descriptors: *Phosphorus, *Trophic level, *Lake classification, Lakes, Nutrients, Jones-Bachman phosphorus model, Dillon-Kirchner phosphorus model, Kirchner-Dillon phosphorus model, Walker model, Model studies.

Four empirical phosphorus models were compared using data from 22 western lakes (oligotrophic, oligomesotrophic, and mesotrophic). The Jones-Bachman model and the Walker model results agreed well with observed P concentrations. The Dillon-Kirchner and Kirchner-Dillon models showed poor correlation with observed data. All models tended to underestimate P levels. Assuming that the USEPA National Eutrophication Survey trophic classification is correct, the Jones-Bachman and Walker models misclassified 23% of the lakes; the Dillon-Kirchner models misclassified 35%. (Cassar-FRC)
W83-01906

TEMPERATURE/SEDIMENT MODEL FOR A SHALLOW LAKE,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
For primary bibliographic entry see Field 5B.
W83-01945

COOLING PROCESSES IN DEEP, TEMPERATURE LAKES: A REVIEW WITH EXAMPLES FROM TWO LAKES IN BRITISH COLUMBIA,
National Water Research Inst., Vancouver (British Columbia).
E. C. Carmack, and D. M. Farmer.
Journal of Marine Research, Vol 40, Supplement, p 85-111, 1982. 11 Fig, 73 Ref.

Descriptors: *Mixing, *Destratification, *Lakes, *Thermal stratification, *Reviews, *Thermocline, *Density currents, *Wind-driven currents, Temperate zone, Stratification, Density stratification, Isotherms, Density, Water temperature, *British Columbia.

In deep temperature lakes, the cooling period includes the breakdown of the seasonal thermocline, isothermal overturn as the lake cools through 4 degrees, and winter re-stratification. A review of the few studies that have been performed on the cooling of lakes shows that more information is needed on the mixing processes whereby heat is transferred from the interior of a lake to the surface, where it is lost to the atmosphere. With this fact in mind, a comparison was made of the thermal history and mixing properties of two deep lakes in central British Columbia. Some characteristics of the evolution of thermal structure can be explained by mixed-layer theory. However, at temperatures near 4 degrees, the density, volume and temperature properties of freshwater should be considered. Two- and three-dimensional processes may also influence circulation at various times and/or locations. These processes may include increased mixing associated with large-amplitude internal seiches, retardation of mixed-layer advance by river-induced upwelling, and thermal bar circulation driven by the differential cooling of water in shallow tributary bays. Circulation may also be affected by horizontal density flows resulting from differential wind mixing in sheltered arms of the lake prior to freezing. (Geiger-FRC)
W83-01987

PLANKTONIC CILIATES: THEIR DISTRIBUTION, ABUNDANCE, AND RELATIONSHIP TO MICROBIAL RESOURCES IN A MONOMICTIC LAKE,
McGill Univ., Montreal (Quebec). Dept. of Biology.
M. L. Pace.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 39, No 8, p 1106-1116, August, 1982. 4 Fig, 6 Tab, 42 Ref.

Descriptors: *Biomass, *Protozoa, *Lakes, *Population density, Aquatic populations, Bacteria, Hydrobiology, Plankton, Chlorophyll a, Stratification, Density stratification, Mixing, Pigments, *Georgia, Lake Oglethorpe, Monomictic lakes.

The abundance, biomass, vertical distribution, and seasonal succession of planktonic ciliates were studied over a 13 month period in Lake Oglethorpe, a small monomictic lake near Athens, Georgia. Measurements taken concurrently of bacterial abundance, chlorophyll a, and pheopigments were analyzed for correlations with the biomass of major protozoan species and total protozoan biomass. Ciliate community structure varied mostly between winter mixis and summer stratification. Vertical distribution tended to be uniform except for species with algal symbionts. During stratification, a more diverse community occurred. With the development of anoxia in the hympolimnion, bacteriovirus scuticociliates dominated the community in terms of density and to a lesser extent, biomass. Highest protozoan densities occurred from August through October, while peak biomass occurred in November with blooms of Rhabdostyla. Total ciliate biomass was correlated with pheopigment concentration, but when Rhabdostyla biomass was subtracted, significant correlations were observed between protozoan biomass and chlorophyll a, pheopigments, and bacterial abundance. It was concluded that concentrations of appropriate food resources are important in determining the abundance of heterotrophic ciliates in lake plankton. (Geiger-FRC)
W83-02078

LIGNIN GEOCHEMISTRY OF A LATE QUATERNARY SEDIMENT CORE FROM LAKE WASHINGTON,
Washington Univ., Seattle. School of Oceanography.
J. I. Hedges, J. R. Ertel, and E. B. Leopold.
Geochimica et Cosmochimica Acta, Vol 46, No 10, p 1869-1877, 1982. 5 Fig, 3 Tab, 38 Ref.

Descriptors: *Sediments, *Geochemistry, *Organic carbon, *Lake sediments, Lakes, Lake Washington, *Washington, Phenols, Lignin, Cupric oxide, Oxidation, Sediment cores.

Long term lignin stability and paleovegetation patterns were studied using CuO oxidation products of sediments from an 11 m core of Late Quaternary sediment collected from the mid-basin of Lake Washington, Washington State. Relatively constant yields of lingin-derived phenols from the entire core indicate minimal in situ lignin degradation over the last 13,000 years. Compositional patterns within the phenolic suite and increased corresponding yields from base extracted sediments indicate that sedimentary lignins are preseent predominantly as well preserved plant tissue fragments. Abundance patterns of vanillyl, syringyl, and cinnamyl phenols record four distinct sequences within the core, characterized by: high concentrations of gymnosperm wood in basal horizon of glacial flour, 11-10 m; an essentially pure mixture of nonwoody angiosperm tissues in late Pleistocene sediments, 10-8 m; relatively high concentrations of angiosperm woods in the bottom half of a limnic peat sequence deposited approximately 10,000-7,000 years B.P., 8-4 m; and a progressive enrichment in gymnosperm woods at the expense of angiosperm woods over the last 7,000 years in the upper limnic peat, 4-0 m. Vascular plant tissues account for less than half the total sedimentary organic carbon throughout the core. (Baker-FRC)
W83-02088

THE APPLICATION OF A NEW METHOD FOR THE DETERMINATION OF PARTICLE DEPOSITION ONTO A LAKE,
Trent Univ., Peterborough (Ontario).
H. H. Banks, and J. E. Nighswander.
Ecology, Vol 63, No 5, p 1254-1258, 1982. 4 Fig, 1 Tab, 15 Ref.

Descriptors: *Pollen, *Lakes, *Distribution, Deposition, Air pollution, Planimetry, Water pollution sources, *Ontario, Clear Lake, *Pollutant identification.

A new method is decribed for the determination of total particle deposition onto a lake. Tests are conducted on experimentally determined Tsuga canadensis and Pinus spp. pollen deposition values obtained from traps placed on Clear Lake, Ontario. The method is based on the distance vs. quantity relationship, and uses planimetry to integrate lake surface areas at various distances from shore. The first step in this procedure is to draw isopleths on a map of Clear Lake, connecting points that are equidistant from the shore. Results of pollen calculations made with this method were compared to those calculated with the Thiessen method and a mean method. General agreement among the methods was achieved. The major advantage of the new method is that it can be applied to any lake using only a scaled map and a planimeter, if a general relationship between distance from shore and particle distribution has been or could be established. (Baker-FRC)
W83-02090

A METHOD FOR PREDICTING WINTER OXYGEN PROFILES IN ICE-COVERED ONTARIO LAKES,
Ontario Ministry of the Environment, Rexdale. Limnology and Taxonomy Section.
M. B. Jackson, and D. C. Lasenby.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 39, No 9, p 1267-1272, September, 1982. 2 Fig, 4 Tab, 10 Ref.

Descriptors: *Lakes, *Ice cover, *Oxygen uptake, Respiration, Seasonal variations, Water depth, Oxygenation, Oxidation, Shield lakes, Limestone lakes, Oxygen depletion, *Ontario.

A simple method is presented for predicting oxygen profiles under ice cover in selected Ontario lakes. The oxygen loss rate within individual lake strata over winter can be predicted from the oxygen concentration in each stratum about 5-15 days after freeze-up (at the time of maximum volume-weighted oxygen concentration for the lake). Shield lakes and limestone transition lakes are described by two distinct relationships; the rate of oxygen loss per unit oxygen concentration is greater in the limestone-transition lakes. The lower rates in shield lakes might indicate that these lakes are characterized by oxidizable material that is relatively lesser in quantity and more refractory in quality. To improve the usefulness of the method as presented here, it is recommended that a study be made of factors affecting winter oxygen loss in a variety of lake types. (Baker-FRC)
W83-02099

2I. Water In Plants

THE VASCULAR PLANTS OF THE HACKENSACK RIVER AREA,
Rutgers - The State Univ., New Brunswick, NJ.
M. Foote.
Phytologia, Vol 50, No 1, p 15-45, December 1981. 13 Ref. A-063-NJ(2), 14-34-0001-1132.

Descriptors: *Vegetation survey, *New Jersey, *Taxonomy, Systematics, *Hackensack River Estuary, Hackensack meadowlands, *Vascular plants, Floral list.

The upper Hackensack River-Estuary is located in Bergen County New Jersey. It includes industrial,

residential and commercial areas. An annotated list of vascular plants was produced from collections made by the author from June, 1980 to October, 1981, herbarium records and literature sources. Three hundred-sixty-two (362) taxa are found along the Hackensack River from the Hackensack Meadowlands to the Oradell Reservoir Dam.
W83-01797

SALINITY-PRODUCTIVITY RELATIONSHIPS OF SELECTED PLANT SPECIES FROM THE SUISUN MARSH, CALIFORNIA,
California Univ., Davis. Dept. of Botany.
R. W. Pearcy, and D. E. Bayer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-154450, Price codes: A04 in paper copy, A01 in microfiche. Completion Report, California Water Resources Center, University of California, Davis, November, 1982, 42 p, 15 Fig. OWRT B-189-CAL(1).

Descriptors: *Salinity, *Saline-freshwater interfaces, *Halophytes, *Salt tolerance, Salt marshes, Productivity, Aquatic productivity, *Bulrushes, *California, Suisan Marsh, Spartina, Scirpus, Plant growth, Photosynthesis.

The influence of salinity on the productivity of four plant species occurring or potentially occurring in Suisun Marsh was investigated with laboratory measurement of growth, photosynthetic responses and competitive interactions, and field measurements of water relations, growth and carbohydrate reserves. Special emphasis was placed on the responses of Scirpus robustus and its competitors because of its importance as a waterfowl food source. The results showed that photosynthesis and growth were much more reduced by increased salinity in Scirpus than in Spartina foliosa, Salicornia virginica orcotula cornupifolia. However, at low salinities Scirpus had the highest growth rates. Competition studies showed a strong shift in competitive advantage from Scirpus at low salinities to Salicornia at high salinities. Field studies showed that at most sites where Scirpus occurs, there is a strong seasonal change in salinity from nearly fresh water in the spring to high summer salinity levels. The rapid growth of Scirpus at the low salinity present during the spring may give it a competitive advantage over Salicornia. Scirpus also exhibited considerable tolerance to high salinities--defined here as an ability to survive even though growth was completely stopped. This tolerance may be important since high summer salinities could prevent encroachment of less salt tolerant but highly competitive and less desirable species such as Scirpus acutus or Typha latifolia. We conclude that management plans designed to enhance Scirpus productivity should put as much weight on maintaining an annual cycle of salinity as reducing the yearly average salinity. (Snyder-California)
W83-01802

WETLAND HYDROLOGY AND TREE DISTRIBUTION OF THE APALACHICOLA RIVER FLOOD PLAIN, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
H. M. Leitman, J. E. Sohm, and M. A. Franklin.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, Price: $13.50 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 82-251, 1982. 92 p, 39 Fig, 14 Tab, 70 Ref.

Descriptors: *Wetlands, *Trees, *Distribution patterns, *Flood plains, Soil water, Forests, Hardwood, River basins, Flood stages, Flow duration, Levees, Surface water, Water level, *Florida, Apalachicola River.

The Apalachicola River is part of a 50,800-square-kilometer drainage basin in northwest Florida, Alabama, and Georgia. The river is formed by the confluence of the Chattahoochee and Flint Rivers at Jim Woodruff Dam and flows 171 kilometers to Apalachicola Bay in the Gulf of Mexico. Its flood plain supports 450 square kilometers of bottomland hardwood and tupelco-cypress forests. The most common trees, constituting 62 percent of the total basal area, were five wet-site species; water tupelo, Ogeeche tupelo, baldcypress, Carolina ash, and swamp tupelo. Other common species were sweetgum, overcup oak, planertree, green ash, water hickory, sugarberry, and diamond-leaf oak. Five forest types were defined based on species predominance by basal area. Biomass increased downstream and was greatest in forests growing on permanently saturated soils. Water and tree relations varied with river location because range in water-level fluctuation and topographic relief in the flood plain diminished downstream. Heights of natural riverbank levees and size and distribution of breaks in levees had a major controlling effect on flood-plain hydrology. Depth of water, duration of inundation and saturation, and river location, but not water velocity, were very highly correlated with forest types. (USGS)
W83-01850

THE AQUATIC AND WETLAND VASCULAR PLANTS OF NORTH DAKOTA,
North Dakota State Univ., Fargo. Dept. of Botany.
G. E. Larson, and W. T. Barker.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-167973, Price codes: A20 in paper copy, A01 in microfiche. Water Resources Research Institute Completion Report, North Dakota State Univ., Fargo, January 1983. 453 p, 35 Ref, 1 Append. OWRT A-064-NDAK(1), 14-34-0001-9036.

Descriptors: *Aquatic plants, *Wetland vascular plants, On-site investigations, Ecosystems, Aquatic environment, Publications, *Taxonomy, *North Dakota, *Plant populations, Plant habitats, Plant species, Classification.

A toxonomic treatment of the aquatic and wetland vascular plants of North Dakota is provided as a means of identifying the vascular plants encountered in wetland habitats of the state. The treatment includes diagnostic keys, plant descriptions and statements of range, habitat preferences and flowering/fruiting periods to accommodate the identification of wetland plant species. Infraspecific taxa and their diagnoses are described following species descriptions where appropriate. References to literature on the taxonomy and distribution of many species and species groups are cited in the body of the treatment. Short discussions of taxonomic problems follow descriptions of some problematic groups. The entities covered in the treatise includes 62 families, 152 genera and 390 species of vascular plants. These include 48 species newly recorded for North Dakota since the 1963 publication of Steven's Handbook of North Dakota Plants.
W83-02067

2J. Erosion and Sedimentation

MICROBIAL ACTIVITY AND BIOTURBATION-INDUCED OSCILLATIONS IN PORE WATER CHEMISTRY OF ESTUARINE SEDIMENTS IN SPRING,
New Hampshire Univ., Durham. Jackson Estuarine Lab.
M. Hines, W. H. Orem, W. B. Lyons, and G. E. Jones.
Nature, Vol 299, No 5882, p 433-435, September, 1982. 1 Fig, 20 Ref.

Descriptors: *Interstitial water, *Chemical reactions, *Microorganisms, Sediments, Esturarine environment, Estuaries, Seasonal variation, Bottom sediments, Oscillatory waves, *New Hampshire, Great Bay estuary.

In an attempt to clarify the chain of sedimentary events occuring between the relatively oxidizing, inactive winter and the highly reducing, active summer, several chemical and biological parameters were examined in samples of estuarine sediment collected from February to July of 1980. The combined effects of increasing microbial activity and the onset of rapid bioturbation produced oscillations in the concentrations of pore water constituents in these sediments. Most importantly, metals may undergo rapid speciation changes which could influence the flux of pollutants into the water column and the distribution of sedimentary minerals. (Baker-FRC)
W83-01771

FLOOD CONTROL FAILURE: SAN LORENZO RIVER, CALIFORNIA,
California Univ., Santa Cruz. Dept. of Earth Sciences.
For primary bibliographic entry see Field 4A.
W83-01783

SEDIMENTATION AND APPARENT SEA-LEVEL RISE AS FACTORS AFFECTING LAND LOSS IN COASTAL LOUISIANA,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
For primary bibliographic entry see Field 2L.
W83-01863

MUDFLAT AND MARSH PROGRADATION ALONG LOUISIANA'S CHENIER PLAIN: A NATURAL REVERSAL IN COASTAL EROSION,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
For primary bibliographic entry see Field 2L.
W83-01864

CANALS AND WETLAND EROSION RATES IN COASTAL LOUISIANA,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
For primary bibliographic entry see Field 6G.
W83-01866

REVERSAL OF COASTAL EROSION BY RAPID SEDIMENTATION: THE ATCHAFALAYA DELTA (SOUTH-CENTRAL LOUISIANA),
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
H. H. Roberts, and I. L. van Heerden.
In: Proceedings of the Conference on Coastal Erosion and Wetland Modification in Louisiana: Causes, Consequences, and Options, Baton Rouge, Louisiana, October 5-7, 1981, D. F. Boesch, ed., Fish and Wildlife Service Report FWS/OBS-82-59, September 1982. p 214-231, 14 Fig, 14 Ref. DACW 29-77-C-0163.

Descriptors: *Deltas, *Sedimentation, *Marshes, *Floods, *Mississippi Rivers, *Louisiana, Erosion, Coasts, Progradation, Backwater effect, Water level, Wetlands, Atchafalaya Delta.

In the early 1950's Atchafalaya Bay began experiencing sedimentation, which marked the initiation of a new major delta lobe in the Mississippi River Delta complex. This new era will be characterized by rapid progradation and marshland growth in parts of coastal Louisiana that have been typified by coastal retreat for hundreds of years. As a product of the abnormally severe 1973 flood, the delta became a subaerial feature characterized by sand-rich lobes which are prograding at a rapid rate. During 1972-77 approximately 32.5 sq km of new marsh land was added to Atchafalaya Bay as a product of sedimentation. Similar processes are occurring at the mouth of Wax Lake outlet. Systematic monitoring of changes within the delta system over the last 4 years has shown that delta growth responds directly to flood volume and duration. Analysis of LANDSAT imagery reveals that Wax Lake suffered a net loss of subaerial expression during the period 1976-78. Land loss was reversed during the major flood of 1979. The presence of deltas at Lower Atchafalaya River and Wax Lake outlets has elevated water levels near the coast during floods (backwater effect), causing sediment-rich water to be transported into surrounding marshes. The net effect is marsh aggradation and restoration in flood areas. Rapid sedimentation has reversed the traditional trend of coastal erosion in the vicinity of Atchafalaya Bay and is now initiating a new growth phase of the downdrift chenier plain. (Moore-SRC)
W83-01869

TIME SCALE FOR SCOUR DOWNSTREAM OF HYDRAULIC JUMP,
For primary bibliographic entry see Field 8B.
W83-01889

ANALYTICAL APPROACH TO RIVER REGIME,
Hydraulics Research Station, Wallingford (England).
W. R. White, R. Bettess, and E. Paris.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 108, No HY10, p 1179-1193, October, 1982. 7 Fig, 28 Ref.

Descriptors: *Sediment transport, *Channel morphology, *Stable channels, Rivers, Cross sections, Alluvial channels, Equilibrium, Sand, Gravel.

A new analytical method, based on maximizing sediment transport rates, was developed to predict the hydraulic and geometric character of alluvial channels, both sand and gravel. It used the Ackers and White sediment transport formulas and the White, Paris, and Bettess frictional relationships with the principle of maximum sediment transporting capacity. Results of the method compared favorably with data obtained from the literature. Predictions of channel slopes were more scattered than observations. There was a slight tendency to overestimate slopes. Predictions of widths were generally excellent, except for very large sand channels and for meandering laboratory channels. Predictions of gravel channel widths were not as good as for sand bed rivers. (Cassar-FRC)
W83-01921

BED MATERIAL SORTING IN POOLS AND RIFFLES,
Illinois State Water Survey Div., Champaign.
N. G. Bhowmik, and M. Demissie.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 108, No HY10, p 1227-1231, October, 1982. 3 Fig, 8 Ref.

Descriptors: *Sediment transport, *Low flow, *Sediment sorting, *Riffles, Bed load, Streams, Kaskaskia River, *Illinois, Froude number.

Bed material sorting in two pool-riffle sequences in the Kaskaskia River below Lake Shelbyville, Illinois, was investigated for a discharge of 58 cfs. Data included velocity measurements, water surface and bed profile data, and bed materials (50 samples). Sorting was mainly due to the high bed shear associated with the high velocity of the riffles, where fine matrials were washed away and deposited in the pools downstream. Coarser particles remained in the riffles. This sorting occurred during low discharges when differences in water velocity between riffle and pool were greatest. The water surface profile and the invert slope were steep in the riffles and milder in the pools. The Froude number changed from high in the riffle to low in the pool. Bed material changed from coarser to finer in the riffle-pool sequence. Larger particle sizes were associated with higher Froude numbers and vice versa. (Cassar-FRC)
W83-01925

DYNAMIC WATER ROUTING UTILIZING A PREDICTOR-CORRECTOR METHOD WITH SEDIMENT ROUTING,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W83-02072

LIGNIN GEOCHEMISTRY OF A LATE QUATERNARY SEDIMENT CORE FROM LAKE WASHINGTON,
Washington Univ., Seattle. School of Oceanography.
For primary bibliographic entry see Field 2H.
W83-02088

2K. Chemical Processes

MICROBIAL ACTIVITY AND BIOTURBATION-INDUCED OSCILLATIONS IN PORE WATER CHEMISTRY OF ESTUARINE SEDIMENTS IN SPRING,
New Hampshire Univ., Durham. Jackson Estuarine Lab.
For primary bibliographic entry see Field 2J.
W83-01771

NUTRIENT DISTRIBUTIONS AND THEIR RELATIONSHIPS TO WATER MASSES IN BAFFIN BAY,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia).
A. R. Coote, and E. P. Jones.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 39, No 8, p 1210-1214, August, 1982. 3 Fig, 11 Ref.

Descriptors: *Bays, *Salinity, *Nutrients, *Water temperature, *Chemical stratification, *Distribution patterns, Temperature, Nitrates, Silicates, Phosphates, Thermal stratification, *Baffin Bay.

The distributions of phosphate, nitrate, and silicates in Baffin Bay, situated between Canada and Greenland, were measured and related to water masses identified by salinity and temperature. Samples for nutrient analyses were collected during August and Septmber of 1977 at 14 different stations. Temperature measurements were also taken at selected depths. Results showed a remarkable homogeneity of the water structure throughout Baffin Bay. Nutrient concentrations reflect a three layer structure similar to that defined by salinity and temperature. In the northern and central sections of the bay, nitrate and phosphate concentrations increase by about 50% with depth from below the upper layer to the bottom, whereas silicate levels increase nearly fourfold between these depths. It is suggested that nutrient concentrations can be used to label layer water masses with resolution similar to that provided by salinity and temperature. (Geiger-FRC)
W83-01772

CONCENTRATION AND SPECIATION OF DISSOLVED SUGARS IN RIVER WATER,
Portland State Univ., OR.
M. S. Sweet, and E. M. Perdue.
Environmental Science and Technology, Vol 16, No 10, p 692-698, October, 1982. 7 Fig, 4 Tab, 31 Ref.

Descriptors: *Sugars, *Rivers, *Carbohydrates, Organic carbon, Williamson River, Klamath Marsh, *Oregon, *Humic acids, Glucose, Marshes, Springs, Lakes, Watersheds, *Saccharides, *Dissolved sugars.

Total dissolved sugars concentrations in the waters of Williamson River basin, Oregon, varied from 0.1 to 7.7 micro M at 11 sites. The January to May 1979 sampling included waters from springs, a marsh, a lake, and streams. Pentoses comprised about 50% of the identified sugars. Arabinose, xylose, galactose, and glucose made up the remainder in about equal concentrations; mannose concentrations were very low. Sugar concentrations were lowest in spring water and highest in sites downstream of the marsh. Dissolved sugars accounted for about 2% of total organic carbon in the river system. Fractionation showed that humic-bound saccharides reached 6.5 micro M downstream from the marsh; the polysaccharides were highest (5 micro M) in the marsh sample. Monosaccharides concentrations were low, < 0.5 micro M. Monosaccharides averaged 2.6% of the total sugars; the remainder was equally divided between the other 2 fractions. The ratio of polysaccharides to humic saccharides was higher in lake and marsh samples than in stream samples. Glucose and other hexoses were enriched in the polysaccharide fraction and deficient in the humic saccharide fraction. (Cassar-FRC)
W83-01779

H2O2 LEVELS IN RAINWATER COLLECTED IN SOUTH FLORIDA AND THE BAHAMA ISLANDS,
Rosenstiel School of Marine and Atmospheric Science, Miami, FL.
R. Zika, E. Saltzman, W. L. Chameides, and D. D. Davis.
Journal of Geophysical Research, Vol 87, No 7, p 5015-5017, June, 1982. 1 Fig, 1 Tab, 15 Ref.

Descriptors: *Rainfall, *Chemical composition, *Hydrogen peroxide, *Florida, Miami, *Bahama Islands, Water analysis, Chemical analysis, Storms, Chemistry of precipitation.

Measurements were made of hydrogen peroxide in rainwater collected in Miami, Florida, and in the Bahama Islands. Concentrations ranged from .00001 to .00007 HM. No systematic trends in H2O2 concentration were observed during an individual storm, in marked contrast to the behavior of other anions such as nitrates, sulfates, and chlorides. The data suggest that a substantial fraction of the hydrogen peroxide found in the precipitation was generated by aqueous-phase reactions within the cloudwater rather than via rainout and washout of gaseous hydrogen peroxide. (Baker-FRC)
W83-01914

THE FREE RADICAL CHEMISTRY OF CLOUD DROPLETS AND ITS IMPACT UPON THE COMPOSITION OF RAIN,
Georgia Inst. of Tech., Atlanta. School of Geophysical Sciences.
W. L. Chameides, and D. D. Davis.
Journal of Geophysical Research, Vol 87, No 7, p 4863-4877, June, 1982. 8 Fig, 7 Tab, 73 Ref.

Descriptors: *Cloud physics, *Rainfall, *Chemical reactions, Chemical composition, Chemistry of precipitation, Free radicals, Clouds, Temperature effects, Hydrogen peroxide, Sulfate, Precipitation.

The significance of a chemical mechanism heretofore neglected in studies of cloud chemistry is cited as being significant in its impact on the chemistry of precipitation. The mechanism involves free radicals and reactive ionic species in the aqueous phase. Daylight hours involve scavenging by and incorporation into cloud droplets of OH and HO2 radicals from the gas phase. Once dissolved in cloudwater, these species can undergo rapid aqueous phase chemical reactions, leading to the generation of H2O2. The rapid oxidation of sulfur species dissolved in cloudwater by this free-radical-produced H2O2 as well as by aqueousphase OH radicals could conceivably have a significant impact on the chemical composition of rain. (Baker-FRC)
W83-01916

GRAPHICAL CALCULATION OF ION CONCENTRATIONS IN CALCIUM CARBONATE AND/OR GYPSUM SOIL SOLUTIONS,
Agricultural Research Service, Riverside, CA. Salinity Lab.
D. L. Suarez.
Journal of Environmental Quality, Vol 11, No 2, p 302-308, April-June, 1982. 4 Fig, 1 Tab, 17 Ref.

Descriptors: *Calcium carbonate, *Soil solution, *Graphical methods, Prediction, Gypsum, Ions, Irrigation effects, Chemical composition, Leaching.

There is an acute need for calculations of calcium concentrations in order to evaluate the soil chemistry of irrigated arid lands. However, existing methods for satisfactorily predicting the chemical composition of waters undergoing precipitation or dissolution of calcite and/or gypsum require computer models or entensive numerical calculations which are not convenient for use by such field personnel as water quality specialists and agricultural extension personnel. A new graphical method has been developed for calculating the equilibrium chemical concentration of waters undergoing calcium carbonate and/or gypsum dissolution or precipitation. The procedure requires the assumption that the water is in an open system with carbon dioxide, with the carbon dioxide level controlled

by respiration and diffusion and not influenced by carbonate dissolution and/or precipitation reactions. The procedure incorporates graphical representations of the solubility equations and curves representing the changes in concentration during precipitation or dissolution. The combination of the curves (drawn in concentrations) and solubility lines permits the calculation of equilibrium concentrations for any solution saturated with a calcium carbonate and/or gypsum phase. Corrections can be made for ionic strength and for ion complexation. The graphical procedures allow quick prediction of steady-state concentrations of major species in solution in the absence of ion exchange. Comparison of the results of this procedure with computer simulation showed that the graphical method gave comparable results when applied to various western U. S. irrigation waters and different leaching fractions. (Carroll-FRC)
W83-01971

HIGH-PERFORMANCE LIQUID CHROMATOGRAPHIC SEPARATION AND SELECTIVE DETECTION OF ANIONIC SURFACTANTS. APPLICATION TO COMMERCIAL FORMULATIONS AND WATER SAMPLES,
Amsterdam Univ. (Netherlands). Lab. for Analytical Chemistry.
For primary bibliographic entry see Field 5A.
W83-01984

MICROSAMPLE-FILTERING DEVICE FOR LIQUID CHROMATOGRAPHY OF FLOW INJECTION ANALYSIS,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
For primary bibliographic entry see Field 5A.
W83-02004

INTERFERENCES IN AUTOMATED PHENOL RED METHOD FOR DETERMINATION OF BROMIDE IN WATER,
Kansas Univ., Lawrence. Dept. of Chemistry.
For primary bibliographic entry see Field 5A.
W83-02005

DETERMINATION OF PHOSPHORUS AT THE PARTS PER TRILLION LEVEL BY LASER-INDUCED THERMAL LENSING COLORIMETRY,
Tokyo Univ. (Japan). Dept. of Physics.
K. Fujiwara, W. Lei, H. Uchili, F. Shimokoshi, and K. Fuwa.
Analytical Chemistry, Vol 54, No 12, p 2026-2029, October, 1982. 5 Fig, 2 Tab, 10 Ref.

Descriptors: *Phosphorus, *Colorimetry, *Water analysis, Laser-induced thermal lensing colorimetry, Seawater, Lakes, Chemical analysis.

Determination of parts per trillion levels of phosphorus by the thermal lensing effect is discussed, along with signal processing by a personal computer. This method was applied to the analysis of phosphorus in seawater and lake water. An Ar+ laser-pumped rhodamine 101 laser was used as the heat and probe source. The signal from a silicon photocell with a 1 sq mm photosensitive surface, which was used as a laser radiation detector, was processed with an inexpensive personal computer. The detection limit is 5 pg of P/mL, which is set mainly by the deviation in the color development with the molybdenum blue method. The analytical results with seawater for two CSK standard solutions of 500 pg of P/mL were 495 and 485 pg of P/mL. The results for the lake water attest to the efficacy of this method for the detection of phosphorus at levels too low to be measured by conventional colorimetry. (Baker-FRC)
W83-02006

CONTINUOUS FLOTATION OF TRACE AMOUNTS OF NITRITE ION IN WATER,
Tokyo Metropolitan Univ. (Japan). Dept. of Industrial Chemistry.
M. Aoyama, T. Hobo, and S. Suzuki.
Analytica Chimica Acta, Vol 141, p 427-430, 1982. 4 Fig, 13 Ref.

Descriptors: *Nitrites, *Water analysis, *Pollutant identification, Water quality, Monitoring, *Spectrophotometry, *Flotation.

A flotation-spectrophotometric method is proposed for the determination of nitrite ion. All the solutions involved, including the sample, are pumped continuously, and the procedure is suitable for the determination of nitrite ion at the microgram/liter level in water. The nitrite (3-40 micrograms/liter) is continuously converted to an azo dye for spectrophotometric measurement at 15-minute intervals. Connection of an appropriate continuous photometric detector to this system will facilitate a continuous nitrite monitoring system. (Baker-FRC)
W83-02007

MICROSCALE FUNCTIONAL GROUP ANALYSIS OF MARINE AND SEDIMENTARY HUMIC SUBSTANCES,
Liverpool Univ. (England). Dept. of Oceanography.
For primary bibliographic entry see Field 5A.
W83-02008

CADMIUM(II) BINDING BY SOIL-DERIVED FULVIC ACID MEASURED BY ANODIC STRIPPING VOLTAMMETRY,
New Hampshire Univ., Durham. Dept. of Chemistry.
For primary bibliographic entry see Field 5A.
W83-02011

AUTOMATED DETERMINATION OF NITRATE IN WATERS WITH A REDUCTION COLUMN IN A MICROCOMPUTER-BASED STOPPED-FLOW SAMPLE PROCESSING SYSTEM,
Illinois Univ. at Urbana-Champaign. School of Chemical Sciences.
For primary bibliographic entry see Field 5A.
W83-02012

DETERMINATION OF MOLYBDENUM IN NATURAL WATERS AFTER SELECTIVE ADSORPTION ON SEPHADEX GEL,
Kyushu Univ., Fukuoka (Japan). Dept. of Chemistry.
For primary bibliographic entry see Field 5A.
W83-02013

DETERMINATION OF ARSENIC AND ANTIMONY IN GEOLOGICAL MATERIALS AND NATURAL WATERS BY COPRECIPITATION WITH SELENIUM AND NEUTRON ACTIVATION-GAMMA-SPECTROMETRY,
Dalhousie Univ., Halifax (Nova Scotia). Trace Analysis Research Centre.
For primary bibliographic entry see Field 5A.
W83-02014

ADSORPTION OF METAL IONS AND METAL COMPLEXES ON CLAY MINERALS: A STUDY OF THE NATURE OF BONDING BY X-RAY PHOTOELECTRON SPECTROSCOPY,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Chemistry.
For primary bibliographic entry see Field 1B.
W83-02058

WATERBORNE NUTRIENT FLOW THROUGHAN UPLAND-PEATLAND WATERSHED IN MINNESOTA,
North Central Forest Experiment Station, Grand Rapids, MN. Forestry Sciences Lab.
For primary bibliographic entry see Field 2D.
W83-02089

2L. Estuaries

GEOLOGY AND HYDROLOGY OF WETLANDS IN MASSACHUSETTS,
Massachusetts Univ., Amherst. Dept. of Geology and Geography.
W. S. Motts, and A. L. O'Brien.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-154419, Price codes: A08 in paper copy, A01 in microfiche. Water Resources Research Center, Pub No 123, Oct 1981, Univ. of Mass., Amherst. 147 p, 9 Tab, 23 Fig, 67 Ref, 3 Append. B-012-MASS(11), B-023-MASS(18). 14-31-0001-3090 and 3596.

Descriptors: *Wetlands, Geology, Hydrology, Groundwater, Groundwater basins, Available water, *Groundwater potential, *Geohydrology, *Groundwater recharge, Aquifers, Surface-groundwater relations, *Groundwater movement, Water supply, Potential water supply, Water management, Well capacity, Water table wells, Artesian wells, Well yield, Artesian basins, Confined groundwater, *Massachusetts, Topographic-groundwater-wetland relationships, Amherst.

The report provides detailed data on three Massachusetts wetlands of varying character in diverse settings. The findings reveal a wide range of differences between wetlands in the extent to which they (1) modify the character of runoff from a basin, (2) influence the discharge/recharge relationship with their underlying aquifer, and (3) affect potential ground-water development. Wetlands cover 6.5% of the land area of Massachusetts. Two thirds of the state's wetlands are underlain by potential aquifers in stratified drift and lake bottom deposits. There is good probability of penetrating high saturated thicknesses of stratified-drift aquifers near wetlands. Artesian aquifers which commonly underlie lakebed-type wetlands are protected from man-induced contamination by the wetland, the clay cap, and the aquifer artesian pressure. This report proposes a classification to define the hydrologic response of wetlands using factors of hydrologic position, geologic type, and topographic position. Important geologic and hydrologic factors include character and thickness of surficial materials; bedrock type; hydrologic position and connection of wetland-related aquifers including permeability of their organic layer, their transmissivity, and their quality; groundwater outflow; and depth of standing water. Important topographic factors are wetland position in the drainage basin and both their relative and absolute size.
W83-01795

A PRELIMINARY CHECKLIST OF MARINE BENTHIC DIATOMS OF MISSISSIPPI.
Mississippi State Univ., Mississippi State. Dept. of Biological Sciences.
M. J. Sullivan.
Gulf Research Reports, Vol 7, No 1, p 13-18, December 1981. 1 Tab, 20 Ref. OWRT A-124-MISS(3), 14-34-0001-9026.

Descriptors: *Diatoms, *Systematics, Biogeography, *Salt marshes, *Soil algae, Ecological distribution, Aquatic habitats, *Mississippi, Marine algae, Sessile algae, Biological communities, Graveline Bay Marsh, Mississippi Sound, Seagrasses, Epiphytic algae, Species checklist.

A checklist of diatoms collected from various benthic habitats in coastal salt marshes and offshore seagrass beds of Mississippi has been compiled for the first time. The checklist includes 213 taxa (species and their varieties) in 43 genera with 19 of these taxa found only on the leaves of offshore seagrasses thus far. Synedra fasciculata var. intermedia (Grun.) Sulliv. comb. nov. is proposed to be consistent with the nomenclature of the nominate variety. Future work with this ecologically important group of marine algae should result in many new additions to this prelimanry checklist.
W83-01798

SIMILARITY OF AN EPIPHYTIC AND EDAPHIC DIATOM COMMUNITY ASSOCIATED WITH SPARTINA ALTERNIFLORA,
Mississippi State Univ., Mississippi State. Dept. of Biological Sciences.
M. J. Sullivan.
Transacitons American Microscopical Society, Vol 101, No 1, p 84-90, March 1982. 2 Tab, 18 Ref. OWRT A-133-MISS(4), 14-34-0001-1126.

Descriptors: *Diatoms, *Salt marshes, Biological communities, *Soil algae, *Sessile algae, *Rhodophyta, Ecological distribution, Marine algae, Aquatic habitats, *Mississippi, Community structure, Species diversity, Epiphytic algae, *Spartina, *Bostrychia, *Caloglossa, St. Louis Bay.

Diatoms were collected from the red algae Bostrychia radicans and Caloglossa leprieurii which were attached to dead stems of Spartina alterniflora and from sandy sediments in which the spermatophytes were rooted in St. Louis Bay, Mississippi. The dominant taxa in both communities were Anaulus balticus, Fragilaria atomus, F. pinnata, and Nitzschia minutula. The epiphytic and edaphic diatom communites possessed a surprisingly high degree of structural similarity as measured by SIMI, despite the fact that diversity was higher in the sediments. This higher diversity characterizing edaphic diatom communities may be a general phenomenon in the marine environment and may be a result of the stabilization of surface sediments by mucilage-secreting pennate diatoms.
W83-01799

PHYTOPLANKTON PRODUCTIVITY, RESPIRATION, AND NUTRIENT UPTAKE AND REGENERATION IN THE POTOMAC RIVER, AUGUST 1977-AUGUST 1978.
Geological Survey, Menlo Park, CA.
Available from OFSS, USGS Box 25425, Fed Ctr, Denver, CO 80225. Paper copy $6.50, Microfiche $3.50. Geological Survey Open-File Report 81-700, May 1981. 51 p, 3 Fig, 6 Tab, 25 Ref. Cole, B. E. and Harmon, D. D., ed.

Descriptors: *Bays, *Estuaries, *Data collections, Phytoplankton, Respiration, Nutrients, Regeneration, Carbon, Hydrogen, Ion concentration, Dissolved oxygen, Potomac River estuary.

Rates of phytoplankton productivity, respiration, and nutrient uptake and regeneration are presented. These observations were made on the Potomac River estuary (POTE) during four cruises between August 1977 and August 1978. Four experimental methods were used: carbon uptake using carbon-14, carbon uptake and respiration by a pH method, productivity and respiration by the dissolved oxygen method, and nutrient (NH_4^+, NO_3^-, NO_2^-, $PO_4^=$, and $SiO_2^=$) uptake and regeneration by colorimetry. The experiments were made at sites representative of conditions in four principal reaches of the tidal Potomac River estuary: near the mouth, seaward of the summer nutrient and phytoplankton maximum, near the region of maximum phytoplankton standing stock, and near the maximum anthropogenic nutrient source. (USGS)
W83-01848

SEDIMENTATION AND APPARENT SEA-LEVEL RISE AS FACTORS AFFECTING LAND LOSS IN COASTAL LOUISIANA,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
R. H. Baumann, and R. D. DeLaune.
In: Proceedings of the Conference on Coastal Erosion and Wetland Modification in Louisiana: Causes, Consequences, and Options, Baton Rouge, Louisiana, October 5-7, 1981, D. F. Boesch, ed., Fish and Wildlife Service Report FWS/OBS-82/59, September 1982. p 2-13, 5 Fig, 14 Ref.

Descriptors: *Sea level, *Wetlands, *Marshes, *Sedimentation rates, *Aggradation, *Estuaries, *Louisiana, Coastal marshes, Salt marshes, Accretion, Deltas.

Rates of apparent sea-level rise and marsh aggradation were determined with the aid of Cs-137 dating, artificial marker horizons, and water level data for the lower Barataria and Calcasieu estuaries. The two study areas are repesentative of the two coastal regions of Louisiana: the chenier and Mississippi deltaic plains. The site within the chenier plain is a brackish to saline Spartina patens marsh known locally as the East Cove marsh, located on the south shore of Calcasiu Lake. The deltaic plain site is the saline Spartina alterniflora marsh surrounding Barataria Bay. These marshes are not vertically accreting at a rapid enough rate to maintain their intertidal elevation and have been subject to net submergence since at least the mid 1950's. This has resulted in a conversion of marsh to open water habitats. Rates of apparent sea-level rise at the two study areas were 1.2 and 1.3 cm/yr from 1954 to present. Sedimentation rates through the same period were approximately 0.7 cm/yr over most of the area of investigation, though streamside marshes aggraded at a rate of 1.35 cm/yr. The transformation of marsh to open water will be complete in a few decades if present trends continue. (Moore-SRC)
W83-01863

MUDFLAT AND MARSH PROGRADATION ALONG LOUISIANA'S CHENIER PLAIN: A NATURAL REVERSAL IN COASTAL EROSION,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
J. T. Wells, and G. P. Kemp.
In: Proceedings of the Conference on Coastal Erosion and Wetland Modification in Louisiana: Causes, Consequences, and Options, Baton Rouge, Louisiana, October 5-7, 1981, D. F. Boesch, ed., Fish and Wildlife Service Report FWS/OBS-82/59, September 1982. p 39-51, 6 Fig, 16 Ref.

Descriptors: *Mud flats, *Coastal marshes, *Sedimentation, *Accretion, *Coasts, *Atchafalaya River, *Louisiana, Suspended sediments, Deltas, Chenier plain, Aggradation.

The chenier plain coast of southwestern Louisiana has beeen receiving sediment intermittently from the Mississippi River for the last 5,000 years. A new influx of fine-grained sediment, the first such sediment pulse in perhaps 500 to 1000 years, is leading to localized coastal progradation along what has historically been one of the most rapidly retreating shorelines in the United States. Carried as suspended sediment by the Atchafalaya mud stream, silts and clays from the Atchafalaya River are now accumulating as mudflats along a segment of coast from Freshwater Bayou Canal to Rollover Bayou. These transitory mudflats provide a buffer to incoming storm waves and serve as a temporary storehouse for littoral sediments. Process-oriented field studies initiated in 1980, together with satellite imagery, color infrared photography, and aerial overflights since 1974, are providing insight as to present and future trends in sedimentation. Growth of the chenier plain appears initially to be by a series of transitory mudflats, a few of which become welded to the shoreline. Since 1969 the pattern of mudflat sedimentation has been increasing and shifting to the west, consistent with the direction of coastal and wave-induced currents. Accelerated growth of the chenier plain is expected when the subaerial Atchafalaya Delta outgrows Atchafalaya Bay, thus allowing an even greater volume of sediments to enter the dynamic shelf region seaward of the bay and to become entrained in the bay and to become entrained in the mud stream. The time scale for widespread reversal in present coastal erosion is 50 to 100 years. (Author's abstract)
W83-01864

EFFECTS OF WETLAND DETERIORATION ON THE FISH AND WILDLIFE RESOURCES OF COASTAL LOUISIANA,
Fish and Wildlife Service, Lafayette, LA.
For primary bibliographic entry see Field 6G.
W83-01867

REVERSAL OF COASTAL EROSION BY RAPID SEDIMENTATION: THE ATCHAFALAYA DELTA (SOUTH-CENTRAL LOUISIANA),
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
For primary bibliographic entry see Field 2J.
W83-01869

ON THE REPRESENTATION OF REYNOLDS STRESS IN ESTUARIES AND SHALLOW COASTAL SEAS,
University Coll. of Swansea (Wales). Dept. of Civil Engineering.
T. J. Smith.
Journal of Physical Oceanography, Vol 12, No 8, p 914-921, August, 1982. 8 Fig, 19 Ref.

Descriptors: *Model studies, Hydrodynamics, *Flow characteristics, *Estuaries, *Turbulent flow, *Shallow water, Mathematical studies, Mathematical models, Tidal hydraulics, Eddy diffusion, *Reynolds number, Steady flow, Coastal waters, Stress, England, Humber Estuary.

A model is derived for simulating the Reynolds-stress tensor in three-dimensional hydrodynamic models of shallow water flows in estuaries and shallow coastal seas. The model combined the accuracy of turbulence-energy closure schemes with the computational efficiency of algebratic eddy viscosity models. The model assumes the eddy-viscosity tensor to have structural similarity, from which it is shown that its magnitude is scaled on the depth-mean turbulence energy and the depth-mean turbulence-energy dissipation rate. The vertical structure is decribed by a similarity function, of which two alternatives are derived. Similarity assumptions used in the analysis are verified. the model was applied to both steady and tidal flows. (Geiger-FRC)
W83-01913

SELF-SIMILAR PARTICLE-SIZE DISTRIBUTIONS DURING COAGULATION: THEORY AND EXPERIMENTAL VERIFICATION,
California Univ., Berkeley. Div. of Sanitary, Environmental, Coastal, and Hydraulic Engineering.
For primary bibliographic entry see Field 8B.
W83-01992

RESIDUES OF O,P'-DDT IN SOUTHERN CALIFORNIA COASTAL SEDIMENTS IN 1971,
California Univ., Davis. Dept. of Wildlife and Fisheries Biology.
For primary bibliographic entry see Field 5B.
W83-02025

AN ECOLOGICAL CHARACTERIZATION OF THE LOWER EVERGLADES, FLORIDA BAY AND THE FLORIDA KEYS,
Florida State Dept. of Environmental Regulation, Tallahassee.
N. S. Schomer, and R. D. Drew.
Fish and Wildlife Service, Biological Services Program Report FWS/OBS-82/52.1, September 1982. 263 p, 62 Fig, 5.1 Tab, 360 Ref. 14-16-009-80-999.

Descriptors: *Wetlands, *Estuaries, *Mangrove swamps, *Salt marshes, *Wildlife, *Ecology, *Florida, Hydrology, Water chemistry, Climate, Watersheds, Salinity, Distribution, Substrates, Marshes, Environmental effects.

A conceptual model of the study area identifies four major ecological zones; terrestrial and freshwater wetlands; Florida Bay and mangrove islands; and the Florida Keys. These are geographically delineated from one another by a combination of elevation gradient and positioning relative to one another and to major outside influences such as upstream watersheds, the continental shelf and major ocean current systems. These zones are delineated by differences in basic physical-chemical background factors such as substrate, climate, hydrology and water chemistry which in turn promote characteristic ecological communities. The terrestrial and freshwater wetlands support pinelands, sawgrass marshes, wet prairies, sloughs and occasional tree islands on freshwater peat, marl and limestone soils. The estuarine and saltwater wetlands support mangrove forests, salt marshes and oscillating salinity systems on mangrove peat, marine marl, sand or 'liver mud' substrates. Florida Bay exhibits oscillating meso-to hypersaline waters over grassbeds on marine lime mud sediments. These mud banks form an anastomosing pattern surrounding deeper 'lake' areas having only a thin veneer of sediment. The exposed tips of the mud banks frequently support mangrove or salt prairie vegetation. The Florida Keys support almost all of the above communities to some small degree but

are more prominently characterized by extensive offshore coral reefs. The productivity of these communities with regard to fish and wildlife reflects: the diversity and type of habitats available to species that are potentially capable of exploiting them; the degree of alteration of these habitats by man and natural forces; and historical, biogeographic and random factors that restrict organisms to specific environments or prohibit them from exploiting a potential habitat. (Moore-SRC)
W83-02036

MATAGORDA BAY, TEXAS: ITS HYDROGRAPHY, ECOLOGY AND FISHERY RESOURCES,
Espey, Huston and Associates, Inc., Austin, TX.
G. H. Ward, and N. E. Armstrong.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-138750, Price codes: A15 in paper copy, A01 in microfiche.
Fish and Wildlife Service, Biological Services Program Report FWS/OBS-81/52, January 1980. 246 p, 126 Fig, 45 Tab, 970 Ref, 1 Append. 14-16-0009-78-066.

Descriptors: *Estuaries, *Hydrography, *Wildlife, *Fisheries, *Watershed management, *Ecosytems, Texas, Resources development, Ecology, Bays, Estuarine environment, Salinity, Dissolved oxygen, Water temperature, Nutrients.

The Matagorda Bay system is one of the principal embayments on the Texas coast. In recent years the Matagorda Bay area and watershed have been subjected to increasing development, and is therefore becoming subject to management problems equivalent to those in other principal Texas embayments. Those problems include the resolution of the stresses imposed by municipal and industrial developments in the bay area, especially the use of water upstream in the drainage basins, with the requirements for sustaining the bay's ecosystem. The functioning of the estuarine ecosystem is sensitive to the distributions of waterbourne constituents such as salinity, dissolved oxygen, temperature and nutrients, which are influenced directly by the alterations to the bay attending development, especially modification of the freshwater inflow. The overall goal of this study is the identification, compilation, and synthesis of hydrographic and biological information in order to assess the fish and wildlife resources of the Matagorda Bay area and to delineate the dependency of these resources upon the hydrographic characteristics of the bay. In order to analyze the Matagorda Bay system and to arrive at operationally useful conclusions within the time frame of the study, an indicator approach was adopted. The indicators for the biological system are 25 key species selected to represent major elements of the bay biological communities. These key species include three seagrasses, seven marsh plants, four shellfish and eleven finfish. The indicator hydrographic-chemical parameters are temperature, salinity, dissolved oxygen and depth. (Moore-SRC)
W83-02037

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

HONULULU OFFERS EFFLUENT-FOR-WATER-SWAP.
World Water, Vol 5, No 9, p 35, September, 1982. 1 Fig.

Descriptors: *Water supply, *Water demand, *Water resources development, Water reuse, Desalination, Wastewater treatment, Drinking water, Potable water, Irrigation, Membranes, *Hawaii, Honolulu, Groundwater.

Due to sudden and significant population growth the Board of Water supply for Honolulu is concerned with its sources of water supply. The volcanic island of Oahu contains vast groundwater reserves. However, total demand on the island will exceed supply by the end of the century. The prime candidate for easing the situation is a wastewater reuse system, which may free some of the potable water currently soaked up by the sugar cane plantations at the rate of more than 90,000 liters/ha. Another idea for increasing potable supplies is currently being examined using inpermeable membrane as a barrier to trap the fresh water which currently flows into the West Loch of Pearl Harbor, just to the west of Honolulu. Different configurations of membrane are possible. Initial research with hydraulic models has proved promising. A blending of brackish and fresh water to an acceptable chloride level, demineralization of electrodialysis and reverse osmosis, and the use of OTEC ocean thermal energy to produce a fresh water byproduct are being considered. (Baker-FRC)
W83-01818

DRAINAGE AND DESALINIZATION OF HEAVY CLAY IN PORTUGAL,
Direccao Geral de Hidraulica e Engenharia Agricola, Lisbon (Portugal).
For primary bibliographic entry see Field 3C.
W83-02022

RESEARCH AND DEVELOPMENT ON SPIRAL-WOUND THIN-FILM COMPOSITE MEMBRANE SYSTEMS,
UOP, Inc., San Diego, CA. Fluid Systems Div.
R. L. Riley, and C. E. Milstead.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-167825, Price codes: A07 in paper copy, A01 in microfiche.
Report, September 17, 1982. 134 p, 32 Fig, 36 Tab, 7 Ref. OWRT C-10062-D(1481)(1), 14-34-0001-1481.

Descriptors: *Reverse osmosis, *Membrane processes, *Desalination, *Chlorine, *Sodium bisulfite, *Trihalomethanes, Bromoform, Demineralization, Halogenated hydrocarbons.

Single-stage desalination of seawater by reverse osmosis requires a membrane which approaches theoretical semipermeability and is sufficiently thin to provide transport of water at practical operating pressures and recovery rates. This objective has been achieved by the development of a family of thin-film composite membranes (TFC) based on nitrogen-containing polymers supported on a fabric reinforced porous supporting membrane. Long-term tests on both cellulose acetate and TFC membrane elements were conducted to determine the effect of trihalomethanes, primarily bromoform, on membrane flux. Both membrane types showed significant flux decline in the presence of part per million quantities of bromoform in a Yuma feed solution. In the part per billion range, minimal flux decline was observed. This indicates that the presence of bromoform in the aqueous phase of the membrane is primarily responsible for the observed flux decline. The use of sodium bisulfite as a reducing agent for chlorinated feed streams has periodicaly been blamed for membrane failure due to the instability of the TFC membrane to bisulfite. Long-term tests conducted with concentrations of sodium bisulfite up to 1500 ppm added to the feed indicated that continuous exposure of TFC membrane systems to low levels of sodium bisulfite should not adversely affect system performance. Long-term field testing of spiral-wound TFC membrane elements at the test facility at Wrightsville Beach, North Carolina, was generally inconclusive since membrane damage due to the frequent presence of chlorine in the feed water precluded obtaining meaningful performance data. (Moore-SRC)
W83-02052

FURTHER TESTING AND DEVELOPMENT OF CONCENTRATION POLARIZATION CONTROL BY ACCELERATION,
SRI International, Menlo Park, CA. Engineering Sciences Lab.
J. C. Eid, and G. B. Andeen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-167833, Price codes: A10 in paper copy, A01 in microfiche.
Report, October 1982. 219 p, 16 Fig, 13 Tab, 15 Ref. 1 Append. OWRT C-10005-S (No 1438)(1), 14-34-0001-1438.

Descriptors: *Reverse osmosis, *Membrane processes, *Desalination, *Particulate matter, *Acceleration, Demineralization, Water treatment, Wastewater treatment, Salts, Concentration polarization.

Experimental data show that acceleration is effective in reducing two of the major problems of reverse osmosis: concentration polarization and particulate fouling. In tests using feed solutions of sodium chloride in varying concentrations. The application of acceleration up to 500 g caused permeate flow increases and salt flow reductions up to 13% in commercial hollow-fiber elements and up to 21% in spiral-wound elements. This indicates a reduction in concentration adjacent to the membrane and provides a margin of safety from precipitation fouling on the brine side of the membrane. The effects of acceleration on particulate fouling were determined by using a solution of 40-ppm iron hydroxide in 0.5% sodium chloride. The processed data indicate an asymptotic decline in desalinate flow with time. The application of 500 g of acceleration allowed a fouled membrane to produce 92% of the membrane's unfouled desalinate flow, whereas the same membrane in a non-accelerated state produced as little as 62% of its unfouled desalinate flow. The capability to reduce concentration polarization and particulate fouling has many advantages; reverse osmosis may be able to deal with more difficult fluids, the use of higher flux membranes is possible, and membrane and pretreatment costs may be reduced. (Moore-SRC)
W83-02053

DESALINATION PLANTS: BETTER WAYS TO MEASURE AND CONTROL PH THROUGH IMPROVED MAINTENANCE AND TRAINING,
F. E. Moore.
Industrial Water Engineering, Vol 19, No 2, p 26-28, March/April, 1982. 4 Fig, 2 Ref.

Descriptors: *Desalination, *Acidity, *Maintenance, Water treatment, Purification, Reverse osmosis, Hydrogen ion concentration, Desalination plants.

Desalination plants are vulnerable to maintenance problems. Some troubles are blamed on poor pH measuring equipment. However, the quality of the equipment is not the central issue. Instead, it is the lack of attention paid to routine maintenance procedures and operator training. Once these needs are met, the life of a desalination plant can be extended significantly. A survey was completed of the full membership of the International Desalination and Environmental Association. All of the respondents indicated that above-average maintenance was needed with pH probes. Most respondents experienced little trouble with reference electrodes, but one-third indicated that they had coating trouble with the glass measuring electrode. About half the respondents used automatic control. (Baker-FRC)
W83-02084

3B. Water Yield Improvement

RELATIVE IMPORTANCE OF GROUNDWATER AND SURFACE-WATER SUPPLIES TO OIL-SHALE DEVELOPMENT, PICEANCE BASIN, COLORADO,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 6D.
W83-01854

3C. Use Of Water Of Impaired Quality

UTILIZATION OF WASTEWATER FOR INTENSIVE FISH CULTURE,
Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife.
H. E. Johnson, and D. J. Duffield.

Available from the National Technical Information Service, Springfield, VA 22161 as PB83-154351, Price codes: A03 in paper copy, A01 in microfiche. Institute of Water Research Completion Report, Michigan State University, East Lansing, September 1980. 34 p, 3 Fig, 5 Tab, 36 Ref, 1 Append. OWRT A-082-MICH(2), 14-31-0001-5022.

Descriptors: *Fish culture, *Wastewater system, Nutrient recycle, Toxic residues, Food supply, *Channel catfish, *Catfish farming, *Michigan, Catfish ponds.

Channel catfish were reared in 0.8 m super 3 cages in southern Michigan farm pond and a pond which received secondary treated domestic wastewater. Cages were stocked in May with 117 mm fingerlings at densities of 50, 100 and 150 fish per cubic meter. The fish production in the farm pond was approximately 44.8 kg/m super 3 compared with 12.5 kg/m super 3 in the wastewater pond. The lower production in the wastewater pond was probably due to adverse water quality conditions including high pH, low dissolved oxygen and high concentrations of unionized ammonia. Total mortality of the fish in the wastewater pond occurred in September when dissolved oxygen levels declined to less than 1.0 mg/l. Fish production was not significantly affected by different stocking densities. The results indicate that cage culture is not suitable in highly enriched wastewater ponds with extensive plant growth but successful cage culture may be practiced in southern Michigan farm ponds.
W83-01788

THE GROWTH AND PRODUCTION OF MOCAMBIQUE TILAPIA (OREOCHROMIS MOSSAMBICUS) FED ON ALGAE IN SMALL TANKS,
Orange Free State Univ., Bloemfontein (South Africa). Inst. of Environmental Sciences.
I. G. Gaigher.
Water SA, Vol 8, No 3, p 142-144, July, 1982. 2 Tab, 12 Ref.

Descriptors: *Aquaculture, *Algae, *Fish food, Wastewater treatment, *Fish ponds, *Tilapia.

Suspended algae from small high-rate algal culture ponds were fed to tilapia (Oreochromis mossambicus) during the periods of 43 and 115 days. Each 225 liter tank received 20 liters of 200-500 mg per liter algal suspensions. Growth was slow, 0.05-0.2 g per fish daily, and was adversely affected by overcrowding. Calculated stocking densities were 222,000 to 444,000 fish per ha; total biomass, 5.4-13.7 tons per ha; and production over 43 days, 1.1-2.5 tons per ha. The low growth rates were attributed to poor conversion of algae and invertebrates, overcrowding, buildup of excretory products between the weekly tank cleanings, and spawning in 3 of the 4 tanks. (Cassar-FRC)
W83-01827

CLOSED CYCLE INDUSTRIAL WASTES CONTROL,
Agricultural Research Service, Kimberly, ID. Snake River Conservation Research Center.
For primary bibliographic entry see Field 5G.
W83-01843

GRAPHICAL CALCULATION OF ION CONCENTRATIONS IN CALCIUM CARBONATE AND/OR GYPSUM SOIL SOLUTIONS,
Agricultural Research Service, Riverside, CA. Salinity Lab.
For primary bibliographic entry see Field 2K.
W83-01971

WATER REGIME AND NITROGEN FERTILIZATION FOR RHODES GRASS IRRIGATED WITH MUNICIPAL WASTE WATER ON SAND DUNE SOIL,
Volcani Inst. of Agricultural Research, Bet-Dagan (Israel). Inst. of Soil and Water.
For primary bibliographic entry see Field 5E.
W83-01975

AMMONIA-OXIDIZING BACTERIA POPULATIONS AND ACTIVITIES IN SOILS IRRIGATED WITH MUNICIPAL WASTE WATER EFFLUENT,
Kimberly-Clark Corp., Neenah, WI.
For primary bibliographic entry see Field 5E.
W83-01976

PREDICTED SOLUTION PHASE FORMS OF HEAVY METALS IN SEWAGE SLUDGE-TREATED SOILS,
Agricultural Research Service, Tucson, AZ.
For primary bibliographic entry see Field 5E.
W83-01977

SOLID PHASE FORMS OF HEAVY METALS IN SEWAGE SLUDGE-TREATED SOILS,
Agricultural Research Service, Tucson, AZ.
For primary bibliographic entry see Field 5E.
W83-01978

DISPOSAL OF FEEDLOT LAGOON WATER BY IRRIGATING BROMEGRASS: I. CROP REMOVAL OF NITROGEN,
Kansas Agricultural Experiment Station, Manhattan. Dept. of Agronomy.
For primary bibliographic entry see Field 5E.
W83-01981

CHALK POINT: A CASE STUDY OF THE IMPACT OF BRACKISH WATER COOLING TOWERS ON AN AGRICULTURAL ENVIRONMENT,
Maryland Univ., College Park. Dept. of Agronomy.
For primary bibliographic entry see Field 5C.
W83-01982

YIELDS OF BAJRA AND WHEAT WITH SALINE WATERS APPLIED THROUGH SPRINKLER AND SURFACE IRRIGATION METHODS,
Haryana Agricultural Univ., Hissar (India).
M. C. Agarwal, R. Singh, S. K. Varma, and K. Singh.
Annals of Arid Zone, Vol 21, No 1, p 9-14, March, 1982. 2 Tab, 13 Ref.

Descriptors: *Irrigation, *Saline water, *Crop yields, *Wheat, *Bajra, Irrigation systems, Water conservation, Water resources development, Water supply, India, Hissar, Sprinkler irrigation.

Field experiments were conducted during kharif and rabi seasons of 1975 to 1978 at Haryana Agricultural University's Research Farm, Hissar, to study the effects of saline water applied through sprinkler and surface methods of irrigation on the performance of bajra and wheat crops and salt accumulation in soil. The results showed that saline water of 11.0 mmhos/cm EC applied by sprinkler reduced bajra yield by 33% but that of wheat by only 3%. Saline water up to 6.0 mmhos/cm EC can be safely applied to bajra by sprinkler in late evening or night hours. The marked reduction in bajra yield with application of 11.0 mmhos/cm EC through sprinklers was mainly due to burning of leaves caused by excessive sodium content in water. This water did not cause comparable damage to the same extent to the wheat crop because of this lower temperatures and higher relative humidity prevailing in the rabi season than in the kharif season. In sprinkler irrigated plots, the salt accumulation in the soil profile was 30-40% less in comparison to surface irrigation. The study showed that the use of highly saline water with sprinkler can be exploited for winter season wheat crops, but its use for summer season crops such as bajra is not feasible. (Baker-FRC)
W83-01999

DRAINAGE AND DESALINIZATION OF HEAVY CLAY IN PORTUGAL,
Direccao Geral de Hidraulica e Engenharia Agricola, Lisbon (Portugal).
M. Mann, A. Pissarra, and J. W. Van Hoorn.
Agricultural Water Management, Vol 5, No 3, p 227-240, 1982. 5 Fig, 11 Tab, 10 Ref.

Descriptors: *Soil treatment, *Saline soils, *Drainage effects, Clays, Gypsum, Leziria Grande, *Portugal, Soil management, Soil physical properties, Soil water, Drainage systems, Subsurface Drainage, Infiltration, *Desalination, Hydraulic conductivity, Groundwater management, Water management, Water table.

Three experimental fields were laid out on saline to very saline heavy clay soils in the Leziria Grande area of Portugal to evaluate methods for improving drainage and desalinzation. Subsurface drains were 1 m deep and 10 and 15 m apart in Field 1; 10, 15, and 20 m in Fields 2 and 3. Surface drains 0.6 m deep and 20 m apart, were installed on parts of Fields 2 and 3 in place of subsurface drains. During the first 3 years (autumn 1976 - spring 1979) rainfall (600-750 mm) exceeded evaporation, leading to drain outflow (250 mm) and desalinization, but during autumn, 1979-spring 1981 rainfall was < 450 mm, producing no drain outflow. All subsurface drainage arrangements were more effective in lowering the groundwater table than surface drainage. Closer drain spacing lowered the groundwater table more rapidly than greater spacing. Subsurface drainage resulted in lower peak discharges (10-20 mm per day) and higher basic discharge rates than surface drainage (peak, 46 mm per day). No effect of drain spacing was observed on the discharge rate or on the total amount of drainage water. Leaching of salts decreased with time over 3 years. Gypsum was applied at 10 t per ha per year for 4 years on Field 1 and on half of Fields 2 and 3. This treatment lowered sodicity and increased infiltration rate and drain outflow. Total amounts of salts in drain water from gypsum plots were 40% higher than in untreated plots. However, no lower soil salinity values were found. Only 20-40% of applied gypsum was actually utilized. (Cassar-FRC)
W83-02022

3D. Conservation In Domestic and Municipal Use

SURVEY OF THE WATER CONSERVATION PROGRAMS IN THE FIFTY STATES: MODEL WATER CONSERVATION PROGRAM FOR THE NATION,
Environmental Policy Inst., Washington, DC.
B. Blackwelder, and P. Carlson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-167866, Price codes: A08 in paper copy, A01 in microfiche. Completion Report, August 1982. 140 p, 30 Tab, 25 Ref, 2 Append. OWRT C-10010-C(1437)(1), 14-34-0001-1437.

Descriptors: Conservation, *Water use, Water supply systems, Costs, *Drought, Water conveyance, Groundwater management, Economic aspects, *Reuse, *Industrial water use, *Municipal water use, Water metering, Water costs, Water scarcity, Water rates, *Water demand, Water storage, Water yield, *Irrigation, Irrigation programs, Groundwater, Water treatment, Water table, Water permits, *Water conservation, *Water policy, *State jurisdiction.

A survey was made of the water conservation programs in each of the fifty states to determine whether each state had a water conservation program or requirement in each of the following thirteen areas: public education, plumbing codes, retrofitting with flow-water-use fixtures, metering, leak detection, rate structures, drought contingency planning, reuse and recycling, outdoor use, groundwater management, industrial use, agricultural use, and government buildings and grants. A brief description of statewide or local programs of significance was prepared for each state. While awareness of water conservation measures is increasing, there is still substantial room for increases in efficiency in water use. The most comprehensive programs are being carried out in California, Massachusetts, Minnesota, and Maryland. Drawing upon the most succesful water conservation programs around the country, we prepared a model water conservation program for domestic and municipal use, industrial use, and agricultural use. Our model program can cut domestic and municipal

use between 15% and 70%. The model program for undustrial use categorizes various methods for reducing undustrial withdrawals and consumption of water and outlines success stories in the steel, chemical, and paper industries. The model program for agricultural use identifies the various techniques for improving the efficiency of water use, describes the potential savings from instituting such measures, points out barriers to efficient use, and suggests ways to overcome the barriers.
W83-02056

THE IMPACT OF WATER SYSTEM PRICING ON CONSUMPTION AND CONSERVATION,
Mississippi Univ., University. Bureau of Business and Economic Research.
W. E. Boyet, K. W. Hollman, S. C. Shull, and C. W. Taylor.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-167924. Water Resources Research Institute Completion Report, Mississippi State University, Mississippi State, September 1982. 79 p, 41 Tab, 18 Ref, 1 Append. OWRT B-026-MS(1), 14-34-0001-1238.

Descriptors: *Water conservation, *Pricing, *Water rates, *Water consumption, Economic impact, *Elasticity of demand, *Water costs, Elasticity of supply, *Mississippi, Southeast US, Northeast US, North Central US, Utilities.

An attempt was made to determine the impact of water pricing policies of water utilities on water consumption. Areas included in the study were the state of Mississippi, and states from the North Central, Northeastern, and Southeastern United States. Of particular interest was the constraining effect on consumption of constant or inclining block prices in contrast to the typical declining block price structure. The study found that most of the water systems in the Eastern part of the United States follow pricing schedules that offer little conservation incentive. Data for the study were obtained by questionnaire in Mississippi and from data published by the AWWA for the other regions. Two stage least squares was used to derive both algebraic-linear and log-linear equations for demand, price, and metered customers for the four areas. Water price elasticities for the three major geographic regions indicated that uniform price systems should experience a much more elastic demand response to price chages than systems with declining block prices. Price elasticities for Mississippi were the reverse, however, perhaps due to its rural nature. The results of the study support the hypothesis that constant or inclining water rate schedules tend to encourage water conservation.
W83-02062

3E. Conservation In Industry

SURVEY OF THE WATER CONSERVATION PROGRAMS IN THE FIFTY STATES: MODEL WATER CONSERVATION PROGRAM FOR THE NATION,
Environmental Policy Inst., Washington, DC.
For primary bibliographic entry see Field 3D.
W83-02056

EVALUATION OF CORROSION IN PULP AND PAPER MILL WHITE WATER REUSE APPLICATIONS,
Mississippi State Univ., Mississippi State. Dept. of Chemical Engineering.
G. R. Lightsey, W. B. Hall, and H. A. Koelling.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-167874, Price codes: A03 in paper copy, A01 in microfiche. Report OWRT/RU-82/16, October 1, 1982, 32 p, 9 Tab, 6 Fig, 23 Ref. OWRT C90322-R(1), 14-34-0001-9439.

Descriptors: *Corrosion control, *Water resuse, *Pulp and paper industry, Corrosion, *White water, *Pulp wastes, *Metals corrosion, *Recycling, *Stainless steel, Tafel Plot Method, Thermal stress, Corroison stress, Corrosion pitting, Mechanical stress.

The purpose of this research was to develop data for predicting the rates of corrosion of common metals at various levels of white water reuse in pulp and paper mill. The white water at a kraft pulp and paper mill was characterized in terms of physical properties that are known to have potential corrosion hazards. Among the physical properties measured were temperature, conductivity, chloride concentration, hardness, sulfate concentration, pH, barium concentration, and sodium concentration. The corrosivity of the white water at various white water recycle rates was determined in the laboratory and under actual mill conditions. Both stressed and unstressed metal coupons were placed in the mill white water and in simulated white water laboratory. The uniform corrosivity, as determined by the Tafel Plot Method, of 304L stainless steel in the laboratory-simulated white water at recycle rates from 80% to 92% was found to be very low. Measurement of the pitting corrosion and stress corrosion of 304L stainless steel both in the laboratory and under mill conditions showed that mechanical stresses had little effect on either the pitting or stress corrosion. However, thermal stresses, in the form of unannealed welds, significantly increased the pitting corrosion in the heat-effected zones of the metal.
W83-02057

3F. Conservation In Agriculture

DEVELOPMENT AND APPLICATION OF ALLOCATION CRITERIA FOR WATER USES AND USERS IN MAXIMIZING VALUE PRODUCTIVITY OF WATER SUPPLIES,
Iowa State Univ., Ames. Dept. of Economics.
J. Timmons.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-167569, Price codes: A03 in paper copy, A01 in microfiche. Iowa State Water Resources Research Institute, Ames, ISWRRI Report No 104, December 1982. 24 p, 8 Ref. OWRT A-067-IA(1), 14-34-0001-8017.

Descriptors: *Supplemental irrigation, Economic aspects, *Iowa, *Groundwater sources, Aquifers, Pumping costs, Linear programming, Alluvial aquifers, Dakota Sandstone Aquifer, *Irrigation costs, Model studies, Cost estimates, Crop yield, *Cost comparisons.

Three case studies of irrigation profitability in northwestern Iowa are summarized in this report. Two possible sources of groundwater for irrigation was considered: The Alluvial Aquifers, which have relatively lower cost of pumping water; and the Dakota Sandstone Aquifer, which has a higher cost of pumping water. The linear programming model also considered three irrigation systems (a center pivot system, a gated pipe system, and a travelling gun system) and three different tillage systems. Irrigation from the Alluvial Aquifers appeared to be profitable. At lower interest rates the center pivot system was found to be preferable over the other two methods, while at high interest rates the gated pipe system, which does not require big initial capital, was preferred. Irrigation from the Dakota Sandstone Aquifer was found to be not feasible in an average year. A multiperiod linear programming model was used to analyze investments in irrigation and four other alternatives: 1) U.S. 4-6 month treasury bills: 2) grade Bbb corporate bonds; 3) high grade municipal bonds; and 4) land as a source of rental income. The rate of return from irrigation was the least of the five options considered. The study also concluded that irrigation does not completely eliminate yield and income fluctuations from weather variability. Techniques for predicting yield increases from irrigation and methods for estimation of the cost of irrigation were developed for eight forms in the study area. Marginal value product curves as more acres are brought in to irrigation were derived. It was concluded that irrigation was an unprofitable venture on the average soil.
W83-01953

POTENTIAL OF DRIP IRRIGATION IN ROW CROPS FOR AGRICULTURE WATER CONSERVATION IN CALIFORNIA,
California Univ., Davis. Dept. of Land, Air and Water Resources.
W. O. Pruitt, D. W. Henderson, E. Fereres, and R. M. Hagan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-167577, Price codes: A03 in paper copy, A01 in microfiche. Completion Report, January 1983, 45 p, 13 Fig, 2 Tab. OWRT A-076-CAL(1).

Descriptors: *Water conservation, *Furrow irrigation, *Drip irrigation, Yield, *Tomatoes, *California, Irrigation management, Irrigation efficiency, Irrigation effects, *Irrigation practices, Irrigation, *Evapotranspiration, Microclimates.

Results are presented of a two year study comparing the evapotranspiration (ET), yields and the microclimate under drip and furrow irrigated processing tomatoes. Results from a water conservation standpoint were not encouraging with approximately equal values of evapotranspiration found for the two methods of irrigation. This was true in replicated field pilot studies as well as the lysimeter studies. The latter studies indicate that although ET under furrow irrigation was considerably higher than under drip irrigation for the three days following each furrow irrigation, this advantage is largely cancelled by a reversal in trends thereafter. Apparently the advection of sensible heat in air and soil to the narrow wet strips under the drip-irrigated canopy produces quite significant evaporation losses in spite of a nearly zero under-canopy radiation. Yield of ripe fruit in the drip irrigated lysimeter exceeded yields in the furrow lysimeter by 9% and 16% respectively in 1979 and 1980. In the replicated field-plot study yields in 1979 were not significantly different between regular drip and furrow irrigated treatment. Yields for the three treatments were respectively 83.8, 66.2, and 58.6 tons per hectare. (Snyder-California)
W83-01954

CROP YIELDS AS INFLUENCED BY RUN-OFF AND SOIL MOISTURE STORAGE,
Central Arid Zone Research Inst., Jodhpur (India).
B. L. Jain, and R. P. Singh.
Annals of Arid Zone, Vol 21, No 1, p 19-23, March, 1982. 3 Tab, 3 Ref.

Descriptors: Water supply, *Crop yield, *Arid zone, *Rainfall-runoff relationships, Farming, Water resources development, *Soil moisture. *India, Pali-Marcoar.

Field trials were carried out for four consecutive years involving micro-catchments having a runoff to run-on ratio of 1:0.75, with a cultivated area of 43% of the total land. Micro-catchments having varying slopes (4, 6, and 8%) and treated differently (bare, tank silt, and bentonite clay) were prepared before the rainy season of 1974. In general, microcatchments, irrespective of slope, provided 50-80% additional run-off to the run-on (cultivated) strips. Runoff yields from micro-catchments having slopes of 4-8% and treated with bentonite clay and tank silt were 4-6% higher as compared to bare micro-catchment. During 1974 only 140 mm rainfall was received during the cropping season. Under control treatment green gram and castor beans failed to give a harvest. However, under the run-off farming treatments, these crops gave a harvest. Even in years where the rainfall was normal some crops still had greater yields due to the extra benefits of the run-off farming scheme. Moisture content of the soil profile in the run-on plots was relatively higher because of additional run-off received from the adjacent run-off strips. In the event of a drought, complete crop failure can be averted by following the run-off farming system. (Baker-FRC)
W83-02000

EFFECT OF MULCHES AND ANTITRANSPIRANTS ON THE GROWTH AND YIELD OF SUNFLOWER EC 68414 UNDER LIMITED WATER SUPPLY,
College of Agriculture, Anand (India).
U. M. Damor, and V. D. Mane.
Annals of Arid Zone, Vol 21, No 1, p 25-28, March, 1982. 1 Tab, 8 Ref.

Descriptors: *Crop yield, *Water conservation, *Irrigation, *Mulches, Black polyethylene, Sawdust, Weed control, Soil moisture, Loam, Water supply, Water supply development, Arid zone, *India, Anand, *Antitranspirants, *Sunflower.

The effect of mulches and antitranspirants on the growth and yield of sunflower crop in rabi season was investigated. The soil was sandy loam with pH of 7.8, low in organic carbon, medium in phosphorus and high in potash content. Seed yield was significantly increased by one irrigation during the growth period during the year of 1975. Of our mulches tested, black polyethylene was significantly better than soil mulch in respect to yield; the latter was at par with wheat husk. Black polyethylene, wheat husk and soil mulch increased yield significantly more than sawdust during the year 1975-76. Use of the antitranspirants showed significantly higher seed yield for phenylmercuric acetate (PMS) as compared to kaolin. The antitranspirants help in conserving water and maintaining favorable water balances. The interaction between antitranspirants and irrigation showed that a significant response to irrigation was obtained when one irrigation was applied during the crop growth period and PAM was sprayed. Interactions between irrigation, antitranspirants and mulches indicated that one irrigation during the crop growth period of black polyethylene mulch and application of PMA yielded the highest seed yield. This may be due to better mositure status and weed control. (Baker-FRC)
W83-02001

A MODEL FOR THE OPTIMAL OPERATION OF AN IRRIGATION SYSTEM,
Demokritos Univ. of Thrace, Xanthi (Greece). School of Engineering.
G. Tsakiris, and E. Kiountouzis.
Agricultural Water Management, Vol 5, No 3, 1982. 3 Fig, 14 Ref.

Descriptors: *Irrigation efficiency, *Economic aspects, *Crop yield, Model studies, *Optimization, Sugar beets, Evapotranspiration, *Irrigation systems.

A procedure in the form of an inventory control model is described for deriving the optimal irrigation policy (depth and timing) which will minimize the total cost per unit time during each stage in the growing season of a single crop. After deriving the water depletion of the plant, the economic loss due to the decrease in yield caused by delaying irrigation and the cost of water application are considered. All variables are viewed as deterministic. An illustration of the method uses a semi-permanent sprinkler irrigation system used on sugar beets in the third stage of growth (June-July). (Cassar-FRC)
W83-02019

RUNOFF AND SOIL LOSS FROM AN OXISOL IN SOUTHEASTERN NIGERIA UNDER VARIOUS MANAGEMENT PRACTICES,
Nigeria Univ., Nsukka. Dept. of Soil Science.
For primary bibliographic entry see Field 4D.
W83-02020

USING A CROP GROWTH SIMULATION MODEL FOR EVALUATING IRRIGATION PRACTICES,
Irrigation and Industrial Development Corp., New York.
S. S. Kundu, G. V. Skogerboe, and W. R. Walker.
Agricultural Water Management, Vol 5, No 3, p 253-268, 1982. 5 Fig, 5 Tab, 13 Ref.

Descriptors: *Irrigation efficiency, *Growth stages, *Water use efficiency, *Corn, Soil moisture deficiency, Model studies, Crop yield, Evapotranspiration, California, Davis, Colorado, Grand Junction.

A crop growth simulation model (CORNGRO) was used to predict the effects of irrigation practices on crop yields, avoiding costly and time-consuming field experiments. Input data were plant characterization parameters, irrigation and daily climatic data, and soil characteristics. Its major parts are the moisture flow program and the plant growth program. The model was applied to: (1) determination of optimum soil moisture depletion and replenishment levels, and (2) timing and amount of irrigation during different crop growth stages. Data from two varieties of corn grown at Grand Junction, Colorado, and Davis, California, were used in the example. Results showed that maximum water use efficiency for Grand Junction was obtained if corn was irrigated when 40% of total available water was depleted; for the Davis site, 60% depletion. Yields were not appreciably affected by increasing the number of irrigations during one or more growth stages. The date and amount of last irrigation was more important if no irrigation was planned in the subsequent growth stage. (Cassar-FRC)
W83-02021

AN ANALYSIS OF TWO PRINCIPLE LEGAL/INSTITUTIONAL CONSTRAINTS TO AGRICULTURAL WATER CONSERVATION IN THE ELEVEN WESTERN STATES.
Teknekron Research, Inc., Berkeley, CA. Industrial Planning Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-167817, Price codes: A07 in paper copy, A01 in microfiche. Report, November 1982. 145 p, 52 Tab, 1 Append. OWRT C-10057-C(1477)(1), 14-34-0001-1477.

Descriptors: *Water conservation, *Legal aspects, *Institutional constraints, *Agriculture, *Water rights, *Water transfer, Salvaged water, Irrigation water, Water banking, Costs, Attitudes, Diversion.

The legal/institutional structures most strongly impending water conservation are the prohibitions against temporary transfer of water rights and water banking, and the legal structures which make it difficult or impossible for an appropriator who salvages water to secure rights to that water. A survey was mailed to between 50 and 70 representative irrigation districts, canal companies and ditch companies in each of the eleven western states. Following the survey, a series of interviews was conducted with water users and water rights administrators throughout the west. Based on these studies, there is a definite correlation between irrigator perceptions of certain aspects of the state's legal structure and the level of conservation activities taken. The greater the perceptions that an appropriator may make short-term water transfers and that a salvager may retain a right to saved water, the more likely that a higher level of conservation activities has occurred. In states that reported a high level of short-term water transfers, there was also a high level of conservation activities and a high irrigator perception of a flexible legal struction. The principal reason why more water conservation activities have not occurred in the irrigation districts interviewed is that additional conservation activities would be too expensive. Irrigators most concerned about the diversion of agricultural water to energy interests were generally those with the least personal knowledge of specific transfers, those who overstated the quantities of water likely to be required by industry, and those who were unaware that most industry diversions are not transformed from irrigators. (Moore-SRC)
W83-02051

SURVEY OF THE WATER CONSERVATION PROGRAMS IN THE FIFTY STATES: MODEL WATER CONSERVATION PROGRAM FOR THE NATION,
Environmental Policy Inst., Washington, DC.
For primary bibliographic entry see Field 3D.
W83-02056

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

FLOOD CONTROL FAILURE: SAN LORENZO RIVER, CALIFORNIA,
California Univ., Santa Cruz. Dept. of Earth Sciences.
G. B. Griggs, and L. Paris.
Environmental Management, Vol 6, No 5, p 407-419, September, 1982. 11 Fig, 4 Tab, 9 Ref.

Descriptors: *Flood control, *Planning, *Flood channels, Rivers, Channels, Engineering, Construction, San Lorenzo River, *California, Water management, Levees, Channel scour, Scour, Floods, Flood damage.

The San Lorenzo River on central California coast was the site of a major US Army Corps of Engineers flood control project in 1959. By excavating the channel below its natural grade and constructing levees, the capacity of the river was increased in order to contain approximately the 100 year flood. However, over the years the production and transport and transport of large volumes of sediment from the river's urbanizing watershed has filled the flood control project with sand and silt. The natural gradient has been reestablished, and flood protection has been reduced to that sufficient for containment of about the 30 year flood. Either an expensive annual dredging program must be started, or replanning and rebuilding of the inadequately designed flood control channel must be undertaken. It is concluded that large flood control projects provide a false sense of security and commonly produce unexpected channel changes. (Baker-FRC)
W83-01783

THE JONGLEI CANAL--NEEDED DEVELOPMENT OR POTENTIAL ECODISASTER.,
Khartoum Univ. (Sudan). Inst. of Environmental Studies.
For primary bibliographic entry see Field 6G.
W83-01785

NAVIGATION ON THE WESTERN RIVERS,
N. C. Venzke.
Transportation Research Record, Vol 825, p 15-17, 1981.

Descriptors: Water resources development, *Inland waterways, *Navigation, *Conferences, *Dredging, *Channel improvement, Evaluation, Water management, Transportation, Safety, Bridges, Locks, Dams.

The Second U. S. Coast Guard District is responsible for safe navigation on the western river system which extends into the industrial and agricultural heartland of the United States. The Second Coast Guard District marks the channels of the system and provides unlighted shore aids to navigation. The Coast Guard is working to improve communications between river interests and provide a viable feedback system. Eight regional (aids-to-navigation) conferences were set up, and the possibility of doubling cargo tonnage on the Upper Mississippi by the year 2000 was explored. The trend of over-dredging or over-depth dredging could become a threat to the safety of navigation. Under the Great I study, a 50-year channel maintenance plan would reduce the depth of the dredge and reduce channel widths in some areas. Reduced channel depths could seriously affect marine safety and may result in spills of hazardous cargoes. As channel depth is reduced, vessel fuel consumption is likely to increase. The Great II study identified bridges that produce high accident rates due to inadequate tow width to bridge openings. Corrective action is proceeding well on two of these bridges. Maintenance of the integrity of locks, dams, and bridges is of

vital importance to national transportaion needs. (Geiger-FRC)
W83-01831

FLOOD FREQUENCY ANALYSIS FOR REGULATED RIVERS,
For primary bibliographic entry see Field 2E.
W83-01833

COMPARISON OF EFFECTIVENESS OF MANAGEMENT OPTIONS FOR WETLAND LOSS IN THE COASTAL ZONE OF LOUISIANA,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
For primary bibliographic entry see Field 6G.
W83-01870

EFFECT OF HYDRILLA MANAGEMENT BY HERBICIDES ON A PERIPHYTON COMMUNITY,
Florida Univ., Gainesville. Center for Aquatic Sciences.
L. M. Hodgson, and C. C. Carter.
Journal of Aquatic Plant Management, Vol 20, p 17-19, January, 1982. 3 Fig, 1 Tab, 8 Ref.

Descriptors: *Aquatic weed control, *Herbicides, *Algae, Performance evaluation, Weed control, Aquatic weeds, Algal growth, Biomass, Primary productivity, Population dynamics, Chlorophyll a, Macrophytes, *Florida, Lake Pearl.

Exotic submergent aquatic weeds such as hydrilla (Hydrilla verticillata (L.f.) Caspary) present a significant economic problem and are particularly difficult to control. The effect of herbicide treatment of hydrilla on the associated periphyton community was investigated in Lake Pearl, located in Orange County, Florida. Chloriphyll a, cell numbers, and biovolumes were determined for the algae of the periphyton community associated with hydrilla infesting the lake following four different chemical treatments. Half of the lake was treated with chemicals on four occasions, while the other half of the lake served as a control area. Treatment with diquat and copper and with diquat and copper plus endothall resulted in increases in periphyton chlorophyll a and biovolume and reductions in hydrilla. A third treatment with diquat and copper and endothall and copper was less effective in reducing hydrilla, although it resulted in an increase in the periphyton community. The final treatment with diquat and copper controlled the hydrilla, but increases in periphyton communities were not significant. These results demonstrate an increase in periphyton communities following herbicide treatments to control hydrilla, suggesting that the removal of one component from the system may not have a signigicant effect on the total biomass of all primary producers in the system. (Carroll-FRC)
W83-01891

WATER RESOURCES AND GROWTH MANAGEMENT IN SOUTH FLORIDA,
Hole, Montes and Associates, Inc., Naples, FL.
For primary bibliographic entry see Field 6F.
W83-01895

MODEL FOR OPTIMAL SIZE AND LOCATION OF DETENTION,
Texas Univ. at Austin. Dept. of Civil Engineering.
L. W. Mays, and P. B. Bedient.
Journal of the Water Resources Planning and management Division, Proceedings of the American Society of Civil Engineers, Vol 108, No WR3, p 270-285, October, 1982. 8 Fig, 2 Tab, 19 Ref.

Descriptors: *Detention reservoirs, *Urban watersheds, *Storm runoff, Storm water, *Model studies, *Optimization, Urban runoff, *Dynamic programming, Water storage, Water management, Surface water, Runoff, Water control, Watershed management.

A model is developed to determine the minimum cost, size and location of detention basins for urban watersheds. Based on dynamic programming, it can handle any arbitrary arrangement of detention basin locations and sizes. The concept of iso-drainage lines is used to introduce physical and design constraints into the model. Channel routing is done using a hydrograph time lag model. Detention basin routing is performed using a fourth-order Runge-Kutta solution of the continuity equation. This model considers many designs and selects the minimum cost solution for the specified physical and design limits. This is an improvement over conventional models, which can consider only a few alternatives. A sample problem using a hypothetical 10 sq mi rectangular watershed divided into 1 sq mi catchments is given. Its goal was to decrease the peak flow rates experienced after urbanization to the rates observed before development for a given rainfall frequency. A constraint was channel capacity. The solution for this probelm (5-100 year storms) was a total detention storage volume of 0.12 to 0.23 acre feet per acre and land requirements of 2.5-4%. For the 100 year storm three basins were chosen, 104.1, 77.7, and 76.2 acres, with the largest basin located farthest upstream. No detention storage was needed in the lower 1/3 of the watershed. (Cassar-FRC)
W83-01910

POINT-SLOPE APPROACH FOR RESERVOIR FLOOD ROUTING,
University of Southern California, Los Angeles. Dept. of Civil Engineering.
S. S. Butler.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 108, No HY10, p 1102-1113, October, 1982.

Descriptors: *Flood routing, *Hydrographs, *Reservoir operation, Point-slope method, Design storms, Design floods, Reservoir design.

A new point-slope method for routing floods resulting from statistically derived design storms is given as an alternative to traditional methods for routing floods through reservoirs. Instantaneous-time functions in the form of equations and criteria are used to determine the hydrograph slope at various points and the inflection point of the rising limb of the outflow hydrograph characteristics of the outflow structure. The check and adjustment procedure for improving routing solutions and the criteria for determining the inflection point may be used for traditional methods as well. Although the point-slope method is limited to simple single-peaked inflow hydrographs, it is fast, accurate, and adaptable for studying alternate reservoir and spillway designs. The point-slope method avoids the errors of the traditional methods (a degree of neglect of hydrograph curvature, carrying of arithmetic errors through several steps, and decisions in converting incremental step computations to smooth hydrographs). The error inherent in the point-slope method arises from drawing the outflow hydrograph through the trend of the point-slope lines. (Cassar-FRC)
W83-01927

DESIGN OF DUAL DRAINAGE SYSTEMS USING SWMM,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
J. H. Ellis, E. A. McBean, and G. Mulamoottil.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 108, No HY10, p 1222-1227, October, 1982. 1 Fig, 1 Tab, 6 Ref.

Descriptors: *Urban drainage, *Storm water, *Model studies, *SWMM model, *Ontario, Errors, Drainage, Runoff, Rainfall-runoff relationships, Hydrologic models.

This paper points out errors inherent in the traditional approach to modeling of dual drainage systems for urban areas using the Storm Water Management Model (SWMM) and suggests improvements in the procedure. Storm water drainage systems normally have dual components, minor (underground pipe system) and major (surface overland flow). The two-stage approach historically used in modeling produces erroneous responses because inputs from the two components do not reflect each other's presence. System flow is underpredicted, and pollutant maximum flux is overpredicted. To improve model performances, the input parameters for the major drainage system are adjusted, and the minor system is left untouched. A case study involving a 50 acre subdivision in Ontario illustrates the adjustment procedure. Good results were obtained after 6 model parameter iterations. (Cassar-FRC)
W83-01929

DISSIPATION OF 2,4-D RESIDUES IN LARGE RESERVOIRS,
Corps of Engineers, Washington, DC.
For primary bibliographic entry see Field 5B.
W83-01932

CONTRIBUTION OF SNOWMELT TO THE OCTOBER 1978 FLOOD OF THE POMAHAKA AND FRASER RIVERS, OTAGO,
Otago Univ., Dunedin (New Zealand).
For primary bibliographic entry see Field 2C.
W83-01988

SOME RAINFALL FEATURES OF JULY 1979 STORM OVER LUNI BASIN,
Central Arid Zone Research Inst., Jodhpur (India).
For primary bibliographic entry see Field 2B.
W83-02002

A DESIGN-DISCHARGE CALCULATION METHOD BASED ON THE PARALLEL USE OF RESERVOIR MODELS,
Louvain Univ. (Belgium). Dept. of Agricultural Engineering.
G. Wyseure, J. Feyen, and J. Berlamont.
Agricultural Water Management, Vol 5, No 3, p 205-214, 1982. 3 Fig, 1 Tab, 11 Ref.

Descriptors: *Design floods, *Hydrologic models, *Hydrographs, Rainfall-runoff relationships, *Belgium, Model studies, Runoff, Groundwater movement, Drainage, Reservoir models, Urban runoff, Surface runoff, Simulation analysis.

Discharge peaks in complex catchments have several components: fast and slow groundwater drainage, surface runoff, and urban runoff. All components must be considered in calculating design discharge. To accomplish this, parallel reservoir models were used in three Belgian catchments: Bellebeek, which has undulating relief, loamy soils, and scattered urbanization; and Wamp and Grote Kaliebeek, both rural, flat, sandy watersheds. For Bellebeek the most suitable model was parallel use of cascades of linear reservoirs. Paved and unpaved areas were derived from cascades of two and three linear reservoirs, respectively. Discharge patterns in Wamp and Grote Kaliebeek were approximately simulated using a continuous parallel model of a single linear reservoir for fast groundwater drainage and one for slow groundwater release. The Kraijenhoff van de Leur resrvoir model was better adapted for simulating peak discharges for these two watersheds. Based on these investigations, models selected for design discharge calculations were the Kraijenhoff van de Leur for groundwater drainage and the cascade model of linear reservoirs for surface runoff. The hydrographs produced by this method provide more information for designing flood control works than a single maximum discharge value. (Cassar-FRC)
W83-02017

MANAGEMENT SCHEME FOR DEVILS LAKE BASIN WETLANDS,
North Dakota State Univ., Fargo.
R. D. Koob, and R. A. Ellison.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-167809, Price codes: A12 in paper copy, A01 in microfiche. North Dakota Water Resources Research Institute Report, March 1981. 263 p, 31 Fig, 39 Tab, 16 Ref. OWRT A-043-NDAK(4), 14-31-0001-5034.

Descriptors: *Wetlands, *Flood control, *Channel improvement, *Flood plain management, *Nonstructural alternatives, North Dakota, Planning,

Flood damage, Flood-control storage, Alternative planning.

The waters of the Devils Lake Basin (North Dakota) and other natural resources of the basin are threatened with deterioration which might endanger the natural stability and economic productivity of the basin. The principal water problem is damage to agricultural crops and land by sheet flooding; however, man's activities are a contributing factor to flooding. In spring, floodwaters overtop the banks of the low-capacity channels. Summer rains also produce streamflows in excess of channel capacities. An inventory and analysis of available data attempted to establish the scope and magnitude of the problems, and to identify cause and effect relationships of natural occurrences, practices and policies. With all of the information in hand from the inventory and anlysis phases, the alternate plan selection phase commenced. Essentially the alternatives were choices of levels of flood reduction, ranging from no action to nearly complete mitigation of flood damages. The Devils Lake Basin Plan which evolved from the selection process consists of a combination of policy statements, recommend studies and programs, and recommend structural and nonstructural measures. Structural measures include: 212 miles of channel improvements, 4 miles of new channel construction, 7 new lake control structures, the modification of one existing lake control structure, 9 grade stabilization structures, and 2 control structures on sloughs. Nonstructural measures include the use of natural water storage sites, land treatment, and the development of a flood plain management program. (Moore-SRC)
W83-02050

4B. Groundwater Management

HIGH PLAINS LOW ON WATER.
For primary bibliographic entry see Field 6D.
W83-01820

GROUNDWATER QUALITY MANAGEMENT,
Oklahoma Univ., Norman.
For primary bibliographic entry see Field 5G.
W83-02032

ASSESSMENT OF FRACTURE-TRACE MAPPING AS A GROUNDWATER PROSPECTING TOOL IN THE METAMORPHIC TERRANE SURROUNDING FAIRBANKS, ALASKA,
Alaska Univ., Fairbanks. Inst. of Water Resources.
R. F. Carlson, D. B. Hawkins, and C. I. Hok.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-167908. Completion Report 80-12, October, 1981. 15 p, 17 Ref, 1 Append. OWRT A-067-ALAS(1), 14-34-001-1102.

Descriptors: *Groundwater, *Alaska, Geology, *Fracture-trace, Sedimentary structures, Metamorphic structures, Joints, Metamorphic rocks, *Photogeology, *Geologic mapping, *Groundwater availability, Fairbanks area.

The development of adequate and reliable groundwater supplies is a persistent problem throughout Alaska, especially in metamorphis and igneous terranes where substantial residential development is taking place. The problem is especially acute in the highland terranes surrounding the two largest metropolitan areas of Alaska, Anchorage and Fairbanks. This project assessed the usefulness of both fracture-trace and lineament mapping for groundwater prospecting in terranes typical to Alaska. If proved useful, this tool will greatly enhance water well location and offer large potential savings to the public. It appears that the terranes in the Fairbanks area will be difficult to analyze, since much of the surrounding hills are covered with windblown silt. However, the higher terranes of the Anchorage and Kodiak areas appear to be ideally suited for analysis with the fracture-trace technique. We hope to continue the work in the Fairbanks area and expand it to the Anchorage area with a grant from the State of Alaska.
W83-02060

MANAGING OUR LIMITED WATER RESOURCES: THE OGALLALA AQUIFER.
Civil Engineering (New York), Vol 52, No 10, p 14, 17, October, 1982. 1 Fig.

Descriptors: *Water management, *Water supply development, *Aquifers, Groundwater, High Plains, United States, Water resources development, *Ogallala aquifer, Irrigation, Water demand.

The Ogallala aquifer spreads under some 20 million acres in Nebraska through Kansas, Colorado, New Mexico and Oklahoma to Texas. Over 150,000 wells have been tapped into this aquifer. Many fear that water is being drawn off at such a rate as to jeopardize High Plains irrigation - leading to severe food shortages. A study is underway which will produce a report in about a year, including the following topics: a subjective appraisal of water management functions and issues, a look at methods as reflected by the principles and standards, and a look at procedures for integrating structural and non-structural methods and integrating quantity and quality issues; a discussion of topics which define water availability, permit requirements and other regulatory considerations; a discussion of cost allocation and cost sharing; and the allocation of water management responsibilities among the several levels of government in the federal system. (Baker-FRC)
W83-02075

4C. Effects On Water Of Man's Non-Water Activities

PREDICTION OF STORM-INDUCED SEDIMENT YIELD FROM HIGHWAY CONSTRUCTION,
L. M. Younkin, and G. B. Connelly.
Transportation Research Record, Vol 832, p 1-6, 1981. 3 Fig, 3 Tab, 14 Ref.

Descriptors: *Prediction, *Mathematical models, *Soil erosion, *Sediment yield, *Storm runoff, *Highway effects, *Road construction, Model studies, Erosion, Sediment transport, Stream erosion, Mathematical equations, Environmental effects.

A mathematical model was developed for predicting storm-induced increases in suspended sediment yield in a stream system due to highway construction. A prediction equation was formulated by regression analysis of data collected at nine streamgage sites in five watersheds in Pennsylvania. The analysis emcompassed 278 data sets. The model relates factors describing soil erodibility, rainfall, construction phases and proximity to the construction site to the increased quantity of sediment transported. Results show that the amount of sediment transported increases with soil erodibility, storm-erosion index, area cleared and grubbed, cut-and-fell heights, and proximity of construction to the stream. The standard error of the final form of the equation was large, although not exceptional when compared with the results of other sediment-transport studies. The equation may be used as a tool in highway location studies, evaluation of highway development impact, and design of sediment catchment devices. (Geiger-FRC)
W83-01832

4D. Watershed Protection

EROSION CONTROL AT CONSTRUCTION SITES ON RED CLAY SOILS,
Wake Forest Univ., Winston-Salem, NC. Dept. of Biology.
A. D. Lemly.
Environmental Management, Vol 6, No 4, p 343-352, July, 1982. 4 Fig, 5 Tab, 52 Ref.

Descriptors: *Erosion control,. *Construction. *Sedimentation, *Clays, Runoff, Urban runoff, Mulches, Denudation, *North Carolina, Red clay soils, Soil erosion, Sediments.

Five single treatments and a multiple treatment for stabilizing soil at urban and highway construction sites were compared using experimental plots of North Carolina red clay soil and natural rainfall episodes from April to June 1981. Plot slopes were 10-50%. The most effective erosion control method was the multiple treatment (chemical soil binder, fiberglass erosion check at the slope base, and asphalt-tacked straw overlain with staple-tacked jute netting). Single treatments consisted of asphalt-tacked straw, jute netting, mulch blanket, wood chips, and staple-tacked excelsior blanket. Reductions in total mean sediment were (with the smaller values representing 50% slope and the large values, 10% slope): tacked straw, 23-42%; jute netting, 30-55%; mulch blanket, 52-76%; wood chips, 51-78%; excelsior blanket, 52-78%; and multiple treatment, about 90%. The percent reduction of coarse particles (< 0.04 mm diameter) in the eroded material varied from $> 96\%$ at 10% slope to 70-82% at 50% slope. The percent reduction of fine particles (<0.04 mm diameter) varied from 2-4% at 10% slope to 18-30% at 50% slope. Although grass cover exceeded 90% on all plots after 60 days, sediment yield was not decreased on tacked straw and jute netting because of poor rooting and piping. These results indicate the importance of considering the fine sediment component, most damaging to aquatic life. Although total sediment load may be reduced by 75%, considerable fine material may be put into receiving waters, especially at the higher slopes seen in highway cuts. Although the multiple treatment approach is clearly superior to single treatments in controlling erosion on these soils, the extra cost is a deterring factor. (Cassar-FRC)
W83-01774

BIOTECHNICAL BANK STABILIZATION,
Newark Dept. of Public Works, DE.
A. W. Fridl, and M. W. Demetrious.
Public Works, Vol 113, No 10, p 62-63, October, 1982. 2 Fig.

Descriptors: *Bank stabilization, *Gabions, *Erosion control, Biotechnical bank stabilization, Christiana Creek, Newark, *Delaware, Channel erosion, Stream stabilization, Willows, Bank erosion, Bank protection.

Banks of the Christiana Creek at Newark, Delaware, were stabilized by a biotechnical method, which combined stone, timbers, and vegetation. The plan called for two 100 ft long, 8 ft high gabions, a 110 ft long timber crib-gabion mat combination, 4 gabion deflectors, and 135 willow shoots planted in and around the structures and on the banks. No dredging, widening, or significant changes were made in the existing hydraulic features of the channel cross section. Deflectors were placed where the creek turned 90 degrees and was eroding the outer bank. Ten months after installation the deflectors were providing the desired effect, buildup along the east bank and cutting on the west bank. Total cost for the project was $50,000. (Cassar-FRC)
W83-01810

MODEL STUDY OF LOW DROP GRADE CONTROL STRUCTURES,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
For primary bibliographic entry see Field 8B.
W83-01888

ENVIRONMENTAL EFFECTS OF A MEDIUM-FERTILITY 12-MONTH PASTURE PROGRAM: I. HYDROLOGY AND SOIL LOSS,
Agricultural Research Service, Coshocton, OH. North Appalachian Experimental Watershed.
For primary bibliographic entry see Field 5G.
W83-01973

PREDICTION OF PHOSPHORUS LOSSES IN RUNOFF FROM SOUTHERN PLAINS WATERSHEDS,
Oklahoma State Univ., Stillwater. Dept. of Agronomy.
For primary bibliographic entry see Field 5B.
W83-01979

RUNOFF AND SOIL LOSS FROM AN OXISOL IN SOUTHEASTERN NIGERIA UNDER VARIOUS MANAGEMENT PRACTICES,
Nigeria Univ., Nsukka. Dept. of Soil Science.
M. E. Obi.
Agricultural Water Management, Vol 5, No 3, p 193-203, 1982. 5 Fig, 2 Tab, 17 Ref.

Descriptors: *Infiltration, *Surface sealing, *Vegetation effects, Runoff, Oxisol, *Nigeria, Soil surfaces, Erosion control, Soil erosion, Soil conservation, Sediment yield, Soil management, Agricultural runoff.

Infiltration, runoff, and soil loss were studied on oxisol with 5% slope on an experimental farm in Nigeria using six management practices: (1) bare fallow, (2) maize on flat cultivated soil, mulched, across the slope, (3) maize on flat cultivated soil, unmulched, across the slope, (4) sweet potatoes, (5) legume, and (6) grass. Infiltration rates (mm per hour) after 3 hours were: bare fallow, 235; maize with no mulch, 400; grass, 650; legume, 750; and mulched maize, 947. During the first hour infiltration on grass plots reached over 1800 mm per hour. No runoff or soil loss occurred on legume, grass, and sweet potato plots. During the 2 years of study, 1979 and 1980, bare fallow had the highest runoff and soil loss, 177-204 mm and 5.5-3.5 kg per sq m, respectively. Unmulched maize runoff and soil losses were intermediate; mulched maize results were 12-17 mm and 0.1-0.2 kg per sq m. The major cause of poor infiltration in this soil was surface crusting. (Cassar-FRC)
W83-02020

DEVELOPMENT AND APPLICATION OF MODELS FOR ANALYZING WATER RESOURCE USE AND DEVELOPMENT WITHIN A REGIONAL FRAMEWORK OF ECONOMIC GROWTH AND ENVIRONMENTAL QUALITY,
Iowa State Water Resources Research Inst., Ames.
For primary bibliographic entry see Field 5G.
W83-02063

PROTECTIVE SOIL STABILIZATION FOR RIVER SLOPES,
R. Boyes.
Civil Engineering (London), p 19, 21, 23, 25, September, 1982. 5 Fig, 13 Ref.

Descriptors: *Slopes, *Erosion control, *Vegetation, Chemicals, Rivers, River slopes, Runoff, Rainfall, Erosion, Flood control.

Vegetation consisting of grasses and woody plants has two roles to play for embankment slope stabilization. First, it acts as a mechanical stabilizing force to buttress up and create arching in the soil, with the deeper penetrating trees and shrub roots acting as tension and compression reinforcement elements. The second role is to provide resistance to wind, rainfall and flood erosion. Here the soil slope surface is protected against both down-slope wash movement and the resulting down-river transport of loosened sediment. This is more the role of grasses. Chemical stabilization of slopes is best employed in forming temporary slope protection on sandy soils down to about SP-SM in general classification above the waterline. The two best chemical treatments appear to be water soluble urethane at seven percent dry material concentration and a cationic asphalt emulsion at 50% dry material concentration. However, both are costly. (Baker-FRC)
W83-02074

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

MICROORGANISMS AS INDICATORS OF TOXICITY OF NATURAL AND WASTE WATERS,
Gorkii State Univ. (USSR). Inst. of Chemistry.
A. A. Tumanov, I. E. Postnov, N. I. Osipova, and I. A. Filimonova.
Hydrobiological Journal, Vol 17, No 5, p 71-74, 1981, 26 Ref.

Descriptors: *Pollutant identification, *Bioindicators, *Biological magnification, Wastewater treatment, *Microorganisms, *Heavy metals, *Trace elements, *Water quality control, Assay, Bioassay, Reviews, Indicators, Bacteria, Water analysis, Toxicity, Molds, Yeasts, Fungi, Monitoring, Trace metals.

The high sensitivity of microorganisms to metal ions, organic and organometallic compounds makes them useful indicators of small amounts of such pollutants in natural waters and wastewater. There is much controversy over whether more highly organized animals such as Daphnia are better indicators of pollution than the lower forms such as bacteria, Protozoa and algae. Some biotesting methods based on biochemical or physiological responses of microorganisms cannot always be used because of their complexity. The simplest biotests are often those based on changes in growth rates of microorganisms in a given chemical environment. Certain molds, yeasts and bacteria grow well on nutrient media and can be used as analytical indicators. The diffusion method may be used for determining the presence of phenol and petroleum products in wastewater with the aid of bacteria and yeasts. Automatic devices which continuously grow microorganisms are used for monitoring the toxicity of industrial effluents. Some bioactive agents can stimulate the growth of living organisms. The method of element determination which is based on stimulation effects can be used to detect the presence of trace elements in water. Biological concentration by organisms can be used as a process whereby rare and scattered elements could be extracted or as a method of purifying and analyzing wastewater. If solutions contain small amounts of toxic substances which cannot be directly detected, then chemical and biological methods of concentration need to be combined. In biological testing, other impurities in the water generally do not interfere with the analysis thus eliminating the need for sample preparation. (Geiger-FRC)
W83-01753

ION CHROMATOGRAPHIC DETERMINATION OF ANIONS IN RAINWATER,
Niigata Coll. of Pharmacy (Japan).
K. Oikawa, and H. Saito.
Chemosphere, Vol 11, No 9, p 933-941, September 1982, 3 Fig, 4 Tab, 7 Ref.

Descriptors: *Anions, *Ion exchange, *Acid rain, Pollutant identification, *Chromatography, *Ion chromatography, Fluorides, Chlorides, Bromides, Nitrites, Nitrates, Sulfites, Sulfates, Phosphates.

Ion chromatography (IC) was used for rapid analysis of rainwater for common anions associated with acidity (fluoride, bromide, nitrate, sulfite, sulfate, phosphate, and nitrite) using the standard method. The procedure used a Bionex Corp. Model 14 chromatograph. The sample was filtered with a membrane filter before injection into the apparatus. The 3 x 500 mm separator column contained low-capacity anion exchange resin; the 6 x 250 mm suppressor column, high capacity cation exchange resin. The eluant, 2 nM NaC03/5 nM NaOH, produced good results, except for nitrite determination. By using a standard solution or sample solution with the same characteristics as the eluant, nitrite results were improved. Coefficients of variation were < 10% for all anions. When the detection limit was twice the signal to noise ratio of the baseline, the detection limits (ppm) were: fluoride, 0.01; chloride, 0.02; nitrite, 0.05; nitrate, 0.1, sulfite, 0.5; and sulfate, 0.1. Analysis of rainwater samples collected over a period of 15 min showed the highest ion concentrations at the beginning of the storm (11.4 ppm C1, 5 ppm sulfate, 2.5 ppm nitrate, and 1.75 ppm sulfite), decreasing to < 1 ppm each at about 4 min. IC was also successfully applied to trace analysis of raindrops collected by aircraft. (Cassar-FRC)
W83-01756

HIGH-PERFORMANCE LIQUID CHROMATOGRAPHIC DETERMINATION OF PYRIDAZINONES IN WASTE WATERS. II.
Slovenska Vysoka Skola Technicka, Bratislava (Czechoslovakia). Chemickotechnologiska Fakulta.
J. Lehotay, E. Matisova, J. Garaj, and A. Violova.
Journal of Chromatography, Vol 246, No 2, p 323-326, 1982, 3 Fig, 1 Tab, 5 Ref.

Descriptors: *High performance liquid chromatography, *Pollutant identification, *Wastewater analysis, *Organic compounds, Separation techniques, Organic wastes, *Chromatography, *Gas chromatography, Chemical analysis, *Pyridazinones.

A high performance liquid chromatography method for the determination of pyridazinones in wastewaters was developed. The new method is applicable to very small amounts of sample and may be performed at a speed compatible with routine measurement requirements and reliability. Solvent extraction was performed on a MicroPak CN column using different mobile phases for PCA (5-amino-4-chloro-2-phenyl-3(2H)-pyridazinone) and PCC (4,5-dichloro-2-phenyl-3(2H)-pyridazinone). Recovery experiments were performed using standard solutions of PCA and PCC. Results were evaluated by linear least-squares fitting of the curves of amounts of PCA or PCC injected against peak area. The resulting shapes of the peaks of PCA and PCC were symmetrical. The limits of detection of injected standards were found to be 40 nanograms of PCC and 50 nanograms of PCA in 10 microliters of solution. Levels of PCA in wastewaters ranged from 0.82 to 1.43 milligrams/liter and levels of PCC ranged from 4.02 to 4.21 milligrams/liter. These results suggest that the present method is potentially useful for the detection of trace amounts of PCA and PCC in wastewaters. (Geiger-FRC)
W83-01760

DETERMINATION OF POLAR ORGANIC SOLUTES IN OIL-SHALE RETORT WATER,
Geological Survey, Denver, CO.
J. A. Leenheer, T. I. Noyes, and H. A. Stuber.
Environmental Science and Technology, Vol 16, No 10, p 714-723, October 1982, 2 Fig, 3 Tab, 28 Ref.

Descriptors: *Oil shale, *Organic compounds, *Industrial wastewater, Wastewater analysis, *Pollutant identification, *Dissolved organic carbon, *Gas-condensate retort water, *Polar organic solutes.

Polar organic solutes were quantitatively determined by a variety of analytical methods in process retort water and a gas-condensate retort water produced in a modified in situ oil shale retort. In the process retort water organic compounds consisted largely of nonvolatile organic anions and polyfunctional neutral compounds. The gas-condensate water contained mainly steam-volatile polar compounds. About 50% of the dissolved organic carbon was identified in both waters. Retort water dissolved organic carbon was identified in both waters. Retort water dissolved organic carbon (3000 mg per liter) was 42% fatty acids from C2 to C10, 1.4% aliphatic dicarboxylic acids, 2.2% phenols, 1.1% hydroxypyridines, and 1.2% aliphatic amides. Gas-condensate water dissolved organic carbon (790 mg per liter) was composed of 19.3% aromatic amines, 17.8% phenols, 4.3% nitriles, 3.5% aliphatic alcohols, 2.4% aliphatic ketones, and 1.3% lactones. (Cassar-FRC)
W83-01763

DETERMINATION OF EFFLUENT TOXICITY FROM STATE OF PIGMENTED CELLS AND NEURAL APPARATUS OF FISH SKIN,
Volgograd State Medical Inst. (USSR).
A. L. Burkovskiy, and S. G. Kul'kin.
Hydrobiological Journal, Vol 16, No 5, p 96-99, 1981. 5 Fig, 6 Ref.

Descriptors: *Pollutant identification, *Bioindicators, *Carp, *Perch, *Fish physiology, Toxicity, Indicators, Bioassay, Fish, Water pollution effects, Wastewater pollution, Pigments.

A simple method was developed for determining the toxicity of sewage using the melanocytes and nerve fibers linked to various components of fish skin, including the pigmented cells. After exposure, carp and perch fry and yearlings were fixed in neutral formalin. Scales were removed, and skin samples were examined under a microscopic in transmitted light without staining. Cytoplasmic stains were used to define and describe the configuration of the processes and perikaryon of the pigmented cell. Early damage of the melanocytes upon intoxication is marked by swelling of cytoplasmic processes. In the next stage of intoxication, the melanin granules are transported to the perikaryon. In the next stage of destruction of the melanocytes, the pigmented cells are contracted and degraded. The number and configuration of such affected melanocytes can be statistically evaluated. In the final stage of melanocyte degradation, the innervating apparatus degenerates. The present method can be used under laboratory or field conditions. (Geiger-FRC)
W83-01765

MUTAGENIC ACTIVITY OF ORGANIC MATTER IN AN URBAN RIVER SEDIMENT,
Tokyo Univ. (Japan). Faculty of Pharmaceutical Sciences.
For primary bibliographic entry see Field 5C.
W83-01781

A COMPARISON OF CHEMICAL LOAD ESTIMATION ALGORITHMS USING DATA OBTAINED BY SAMPLING FOUR SOUTH AFRICAN RIVERS AT VARYING FREQUENCIES,
Hydrological Research Inst., Pretoria (South Africa).
D. C. Grobler, C. A. Bruwer, P. J. Kemp, and G. C. Hall.
Water SA, Vol 8, No 3, p 121-129, July, 1982. 8 Fig, 2 Tab.

Descriptors: *Pollution load, *Sampling, Rivers, Water quality, *Algorithms, *South Africa, Nitrates, Phosphates, Dissolved solids, Chlorides, Suspended solids, Pollutant identification, Vaal River, Balfour River, Blinkwater River, Orange River.

Six algorithms for calculating constituent loads from continuous flow records and discrete constituent concentration records were compared using data from four rivers in South Africa. No one algorithm was superior in all cases. The best algorithm had to be selected by considering both the type of constituent (conservative, nonconservative or suspended solids) and the sampling frequency. Generally, the load estimation algorithms overestimated conservative constituents (total dissolved solids and chlorides) loads, underestimated suspended solids loads, slightly overestimated nitrate loads and slightly underestimated phosphate loads. When sampling frequency was reduced in the dry season, accuracy of load estimations was not adversely affected. (Cassar-FRC)
W83-01825

EVALUATION OF INCREASES IN DISSOLVED SOLIDS IN GROUND WATER, STOVEPIPE WELLS HOTEL, DEATH VALLEY NATIONAL MONUMENT, CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
A. Buono, and E. M. Packard.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $2.75 per paper copy, $3.50 in microfiche. Geological Survey Open-File Report 82-513, July 1982. 19 p, 6 Fig, 2 Tab, 16 Ref.

Descriptors: *Groundwater, *Dissolved solids, *Water supply, *Water quality, Path of pollutants, Observation wells, Montoring, Well data, Potable water, Water yield, Water level, Groundwater movement, Reverse osmosis, Mesquite, Data collections, *California, Death Valley National Monument, Stovepipe Wells Hotel.

Increases in dissolved solids have been monitored in two observation wells near Stovepipe Wells Hotel, Death Valley National Monument, California. One of the hotel's supply wells delivers water to a reverse-osmosis treatment plant that produces the area's potable water supply. Should water with increased dissolved solids reach the supply well, the costs of production of potable water will increase. The reverse-osmosis plant supply well is located about 0.4 mile south of one of the wells where increases have been monitored, and 0.8 mile southwest of the well where the most significant increases have been monitored. The direction of local ground-water movement is eastward, which reduces the probability of the supply well being affected. Honey mesquite, a phreatophyte located about 1.5 miles downgradient from the well where the most significant increases have been monitored, might be adversely affected should water with increased dissolved solids extend that far. Available data and data collected during this investigation do not indicate the source of the dissolved-solids increases. Continued ground-water-quality monitoring of existing wells and the installation of additional wells for water-quality monitoring would be necessary before the area affected by the increases, and the source and direction of movement of the water with increased dissolved solids, can be determined. (USGS)
W83-01858

A RAPID, DIRECT HIGH-PERFORMANCE LIQUID CHROMATOGRAPHIC METHOD FOR THE SIMULTANEOUS QUANTITATIVE DETERMINATION OF CARBARYL AND ALPHA-NAPHTHOL IN AQUEOUS SAMPLES,
Southeastern Forest Experiment Station, Research Triangle Park, NC. Forestry Sciences Lab.
A. S. Jones, L. A. Jones, and F. L. Hastings.
Journal of Agricultural and Food Chemistry, Vol 30, No 5, p 997-999, September/October, 1982. 1 Fig, 2 Tab, 11 Ref.

Descriptors: *Water analysis, *Carbaryl, *Organic compounds, Naphthol, *Chromatography, *Pollutant identification, Analytical methods.

A rapid, quantitative HPLC enrichment/analysis procedure was developed for carbaryl (I) and alpha-naphthol(II) in the ppb range in well water. A 2-mL volume of aqueous sample, contained in the sample loop of a Waters Associates U6K injector, is flushed onto the head of a 4.0 mm x 30 cm microBondapak C18 column, where the solutes are adsorbed and concentrated. Elution with a 60:40 methanol-water mobile phase at a flow rate of 1.0 mL/min provided good separation of carbaryl and alpha-naphthol from each other and from all unidentified UV-absorbing compounds present in the water. The utility of Sep-PAK C18 cartridges for storing field-collected aqueous carbaryl samples was demonstrated. Samples can be stored on the cartridges at ambient temperature for 5 days, with subsequent recoveries of 98% and 89% for carbaryl and alpha-naphthol, respectively. (Baker-FRC)
W83-01892

DISTRIBUTION OF TOXIC SUBSTANCES IN RIVERS,
Princeton Univ., NJ. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W83-01902

DETERMINATION OF ABATE IN ENVIRONMENTAL WATER SAMPLES BY DENSITOMETRY ON PREADSORBENT REVERSED-PHASE THIN-LAYER PLATES,
Lafayette Coll., Easton, PA. Dept. of Chemistry.
J. Sherma, and J. L. Boymel.
Journal of Chromatography, Vol 247, No 1, p 201-204, September, 1982. 2 Fig, 9 Ref.

Descriptors: *Pollutant identification, *Thin layer chromatography, *Separation techniques, *Organophosphorus pesticides, Chromatography, Pesticides, Insecticides, Larvicides, Water analysis, Natural waters, *Abate.

The organophosphorus insecticide, Abate (temephos) was determined in water samples by a quantitative thin layer chromatographic method on reversed phase chemically bonded C18 plates with a preadsorbent spotting area. Detection is performed with the selective and sensitive reagent for organophosphorus pesticides, N,2,6-trichlorobenzoquinoneimine (TCQ). Using this procedure, recovery for distilled water averaged 96.0% for four trials, while recovery from fortified blank pond and river waters averaged 88.1% and 83.7%, respectively, for four trials. The combined selectivity of the TLC separation and the detection reagent allowed the natural water samples to be analyzed without cleanup. The present TLC method is able to analyze multiple samples simultaneously under identical conditions and to process standards in parallel. The method is able to analyze residues at low parts per million levels in water with speed, accuracy and precision and may be applied to other sample matrices if certain cleanup steps are carried out. (Geiger-FRC)
W83-01983

HIGH-PERFORMANCE LIQUID CHROMATOGRAPHIC SEPARATION AND SELECTIVE DETECTION OF ANIONIC SURFACTANTS. APPLICATION TO COMMERCIAL FORMULATIONS AND WATER SAMPLES,
Amsterdam Univ. (Netherlands). Lab. for Analytical Chemistry.
F. Smedes, J. C. Kraak, C. F. Werkhoven-Goewie, U. A. T. Brinkman, and R. W. Frei.
Journal of Chromatography, Vol 247, No 1, p 123-132, September, 1982. 10 Fig, 18 Ref.

Descriptors: *Pollutant identification, High performance liquid chromatography, *Separation techniques, *Surfactants, *Fluorometry, Water analysis, Sulfonates, Sulfates, *Chromatography, Biodegradation.

Reversed-phase liquid chromatography coupled with post-column ion-pair extraction detection was used to analyze C10-C18 homologues of sulfonate and sulfate type surfactants using Hypersil SAS and ODS packings and water-acetone mixtures as the mobile phase. An acetone gradient was applied for the separation of more than five successive homologues. Anionic surfactants were detected as ion pairs in mixtures of effluent plus chloroform and acridinium chloride solution. The ion pairs were extracted into the chloroform phase and monitored fluorimetrically. The system behaved linearly for up to 4 micrograms of anionic surfactant injected. The detection limit ranged from 1 to 5 nanograms, regardless of the length of the alkyl chain of the solutes. The method has been found suitable for the analysis of commercial surfactant formulations and the detection of anionic surfactants at parts per billion levels in water samples after preconcentration on a small reversed-phase column. The latter application may be useful in the following the biodegradability of anionic surfactants. (Geiger-FRC)
W83-01984

DETERMINATION OF VOLATILE HALOCARBONS IN RAW AND DRINKING WATER, HUMAN SERUM, AND URINE BY ELECTRON CAPTURE GC,
Abo Akademi, Turku (Finland). Inst. of Wood Chemistry and Pulp and Paper Technology.
M. Reunanen, and R. Kroneld.
Journal of Chromatographic Science, Vol 20, No 10, p 449-454, October, 1982. 4 Fig, 4 Tab, 10 Ref.

Descriptors: *Potable water, *Water analysis, *Gas chromatography, Fresh water, Natural waters, Lakes, Streams, *Organic compounds, *Hydrocarbons, *Pollutant identification, *Halocarbons.

A method for quantitative determination of volatile halocarbons in raw and drinking water, human serum, and urine is presented. Samples of water were extracted in a single step with petroleum ether, and the extracts without further purification were analyzed by high resolution gas chromatography with electron capture detection. Both external and internal calibrations were used to standardize the analytical system. External calibration is done with pure halocarbons in purified well water. Internal calibration is accomplished by spiking serum and urine samples with reference halocar-

bons between each of two successive extractions and GC run. 1-Iodobutane was the internal standard used in both calibrations and actual determinations. (Baker-FRC)
W83-01985

DETERMINATION OF TRACE BERYLLIUM BY GC,
Institute of Nuclear Energy Research, Lung-Tan (Taiwan). Analytical Chemistry Center.
C-J. Kuo, I-H. Lin, J-S. Shih, and Y-C. Yeh.
Journal of Chromatographic Science, Vol 20, No 10, p 455-460, October, 1982. 9 Fig, 2 Tab, 14 Ref.

Descriptors: *Water analysis, *Gas chromatography, *Beryllium, *Uranium oxide, Drinking water, Water quality, *Pollutant identification.

Trace beryllium in uranium oxide and tap water was determined by electron-capture detection. After dissolving, samples were mixed with an ethanol solution of 0.08 N trifluoroacetylacetone to form a single phase system. The Be(TFA)2 complex that formed was extracted to cyclohexane. The excess of free HTFA in cyclohexane was washed with 0.1 M NaHC03 solution; the effects of organic extractants (solvents), pH value, and shaking time on recovery are also discussed. The detection limit with this method was 2 x 10 to the minus 11th power g of Be. The content of Be in tap water could be determined as low as the sub-ppb order. It was also demonstrated that the fluoride ion interfered with the determination of Be. (Baker-FRC)
W83-01986

IMPROVED MICROAUTORADIOGRAPHIC METHOD TO DETERMINE INDIVIDUAL MICROORGANISMS ACTIVE IN SUBSTRATE UPTAKE IN NATURAL WATERS,
Naval Research Lab., Washington, DC.
P. S. Tabor, and R. A. Neihof.
Applied and Environmental Microbiology, Vol 44, No 4, p 945-953, October, 1982. 3 Fig, 2 Tab, 14 Ref.

Descriptors: *Microorganisms, Natural waters, *Radioactivity techniques, *Uptake, *Fluorescence, *Microscopic analysis, *Substrates, Tritium, Aquatic populations, Metabolism, Microbiological studies, Chesapeake Bay, Pollutant identification.

A new method is described which combines epifluorescence microscopy and microautoradiography to determine the total number of microorganisms in natural water populations and those individual organisms active in the uptake of specific substrates. After incubation with tritium-labeled substrate, the sample is filtered and mounted directly in a film of autoradiographic emulsion on a microscope slide while still on the filter. The micro-autoradiogram is processed and stained with acridine orange and the filter is removed before microscopic observation. This procedure gave increased accuracy in direct counts made from the autoradiogram and provided improved sensitivity in the recognition of uptake-active radioactive-labeled organisms. The present method also resulted in the enumeration of a significantly greater number of labeled organisms compared with corresponding samples prepared by a previously reported technique. (Geiger-FRC)
W83-01993

SELECTED NUCLEIC ACID PRECURSORS IN STUDIES OF AQUATIC MICOBIAL ECOLOGY,
Hawaii Univ., Honolulu. Dept. of Oceanography.
For primary bibliographic entry see Field 5C.
W83-01994

THE SEPARATION OF TUNGSTATE AND MOLYBDATE BY ION CHROMATOGRAPHY AND ITS APPLICATION TO NATURAL WATERS,
Geological Survey, Denver, CO.
W. H. Ficklin.
Analytical Letters, Vol 15, No 109, p 865-871, 1982. 1 Fig, 2 Tab, 4 Ref.

Descriptors: *Water analysis, *Ion chromatography, Chemical analysis, Tungsten, Molybdenum, Surface waters, Natural streams, Lakes, Rivers, *Tungstate, *Molydate, *Pollutant identification, Separation techniques.

Ion chromatographic separation of tungstate and molybdate was achieved using a 3 x 250 mm standard anion separator column, a 0.006 M sodium carbonate eluent, a standard anion suppressor column, and a flow rate of 90 ml/hr. Elution of peaks for the species tungstate nd molybdate occurs at 9 and 12 minutes, respectively, and peak heights are distinguishable from the baseline at concentrations of 0.1 mg/liter, using a full scale deflection of 10 micromho and a dual-pen recorder. Tungstate and molybdate must be concentrated from 1 liter of water by collecting them on a chelating resin after the pH of the water was adjusted to between 1 and 2. Tungstate and molybdate were eluted with concentrated ammonium hydroxide. The ammonia was evaporated, leaving a water solution containing tungstate and molybdate. About 90% of the tungsten and molybdenum was recovered, with a relative standard deviation of about 15% at the microgram/liter level. Natural concentrations of tungsten or molybdenum as small as 1 microgram/liter are measured by this technique. (Baker-FRC)
W83-02003

MICROSAMPLE-FILTERING DEVICE FOR LIQUID CHROMATOGRAPHY OF FLOW INJECTION ANALYSIS,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
W. S. Gardner, and H. A. Vanderploeg.
Analytical Chemistry, Vol 54, No 12, p 2129-2130, October, 1982. 2 Fig, 8 Ref.

Descriptors: *Water analysis, *Flow injection, *Filters, Liquid chromatography, *Chromatography, Sampling, Sample preparation, *Pollutant identification.

An efficient technique was developed to remove particles from relatively small samples but still recover sufficient filtrate for analysis. The technique uses a microsample-filtering assembly, interfaced directly with the loop injector of a previously described ammonium analyzer. The device allows the analyst to rinse the filter, filter the sample and load the injection loop with a single sample-handling step. It provides a convenient, desirable method to clean up samples prior to HPLC or flow-injection analysis. The device as described was designed for low-pressure sliding injection valves, but could be used with appropriate adaptors on other loop-injection systems. (Baker-FRC)
W83-02004

INTERFERENCES IN AUTOMATED PHENOL RED METHOD FOR DETERMINATION OF BROMIDE IN WATER,
Kansas Univ., Lawrence. Dept. of Chemistry.
C. L. Basel, J. D. Defreese, and D. O. Whittemore.
Analytical Chemistry, Vol 54, No 12, p 2090-2094, October, 1982. 2 Fig, 4 Tab, 24 Ref.

Descriptors: *Bromide, *Water analysis, *Pollutant identification, *Phenol red method, *Chloride, Ammonium, Bicarbonates, Chemical reactions.

The automation of the phenol red method for the determination of bromide in natural waters is described. Use of segmented flow analysis allows analysis of samples at a rate of 20 samples/hr with a method detection limit, defined as the concentration giving a signal about three times the standard deviation of replicate analyte determinations in reagent water, of 10 micrograms/liter. Samples studies include oil-field brines, halite solution brines, groundwaters. Chloride and bicarbonate cause significant positive interferences at levels as low as 100/liter and 50 mg/liter, respectively. Ammonia gives a negative interference that is important at levels as low as 0.05 mg/liter. An ionic strength buffer is used to suppress a positive ionic strength interference, correction curves are used to compensate for the chloride interference, the bicarbonate interference is minimized by acidification, and the ammonia interference is eliminated by its removal by ion exchange. Reaction product studies are used to suggest a plausible mode of chloride interference. (Baker-FRC)
W83-02005

DETERMINATION OF PHOSPHORUS AT THE PARTS PER TRILLION LEVEL BY LASER-INDUCED THERMAL LENSING COLORIMETRY,
Tokyo Univ. (Japan). Dept. of Physics.
For primary bibliographic entry see Field 2K.
W83-02006

CONTINUOUS FLOTATION OF TRACE AMOUNTS OF NITRITE ION IN WATER,
Tokyo Metropolitan Univ. (Japan). Dept. of Industrial Chemistry.
For primary bibliographic entry see Field 2K.
W83-02007

MICROSCALE FUNCTIONAL GROUP ANALYSIS OF MARINE AND SEDIMENTARY HUMIC SUBSTANCES,
Liverpool Univ. (England). Dept. of Oceanography.
A. H. Gillam, and J. P. Riley.
Analytica Chimica Acta, Vol 141, p 287-299, 1982. 3 Fig, 2 Tab, 29 Ref.

Descriptors: *Humic acids, *Sediments, Chemical analysis, Acidity, Carboxylic acids, *Phenols, *Quinones, *Hydroxamates, Water analysis, *Dissolved organic matter, *Pollutant identification.

Methods are described for the microscale analysis of aquatic and sedimentary humic substances for several oxygen-containing functional groups including total acidity, carboxylic and phenolic hydroxyl groups, quinone groups and hydroxamate linkages. Coefficients of variation of the methods ranged from 4.9 to 12.9%. Elemental analyses of the freshwater and sedimentary humic substances of this study indicate that between 34 and 88% of the oxygen in the aquatic humic substances studied is present in the carboxylic and phenolic hydroxyl groups. For the sedimentary humic substances the range was 18-42%. This clearly shows the dominance of the acidic oxygen-containing functional groups in the aquatic humic compounds. The values for carboxylic and phenolic hydroxyl groups indicate that the marine fulvic acids have carboxyl group concentrations similar to those of freshwater fulic acids. The carbonyl contents of the sedimentary humic acids studied were much lower than those of either the marine or freshwater humic substances, ranging from 1.2 to 3.0 meq/gram, indicating that the humic material had been extensively altered following deposition. Aquatic humic substances were found to contain substantial amounts of quinone groups. (Baker-FRC)
W83-02008

THE DETERMINATION OF CHEMICAL OXYGEN DEMAND IN WASTEWATERS WITH DICHROMATE BY FLOW INJECTION ANALYSIS,
Okayama Univ. (Japan). School of Engineering.
T. Korenaga, and H. Ikatsu.
Analytica Chimica Acta, Vol 141, p 301-309, 1982. 4 Fig, 2 Tab, 13 Ref.

Descriptors: *Chemical oxygen demand, *Water analysis, Wastewater, *Flow injection analysis, Chemical analysis, Oxygen demand, Oxygen, Pollutant identification.

A simple method is described for the continuous determination of chemical oxygen demand (COD) in wastewater samples by flow injection analysis. Samples were injected into a water stream which merges with an acidic dichromate carrier solution. After reaction in a PTFE coil at 120C, absorbances were measured at 445 nm. D-Glucose is satisfactory as a standard substance for COD in a variety of wastewaters. A sampling rate of 15 samples per hour can be achieved, and the detection limit and

precision are 5 mg/liter as COD and 0.4%, respectively. Chloride concentrations of over 100 mg/liter interfere somewhat unless silver and/or mercury salts are added. COD values for various wastewater samples correlate well with those obtained by standard methods using dichromate or permanganate. The method described is suitable for the continuous monitoring of wastewaters. (Baker-FRC)
W83-02009

THE DETERMINATION OF TRACES OF CADMIUM, LEAD AND THALLIUM IN FLY ASH BY POTENTIOMETRIC STRIPPING ANALYSIS,
Aarhus Univ. (Denmark). Dept. of Chemistry.
J. K. Christensen, L. Kryger, and N. Pind.
Analytica Chimica Acta, Vol 141, p 131-146, 1982. 8 Fig, 3 Tab, 21 Ref.

Descriptors: Water analysis, *Fly ash, *Potentiometric stripping analysis, Chemical analysis, *Lead, *Cadmium, *Thallium, Powerplants, Water pollution sources, Pollutant identification.

The suitability of potentiometric stripping analysis for the determination of cadmium, lead and thallium in fly ash and in waters polluted by leaching of fly ash was assessed. By an appropriate choice of medium and of electrolysis potential and by employing a rotating working electrode, it is possible to eliminate interferences from electroactive species often found in fly ash in high concentrations. The accuracy obtained in a study of a certified coal fly ash is satisfactory. (Baker-FRC)
W83-02010

CADMIUM(II) BINDING BY SOIL-DERIVED FULVIC ACID MEASURED BY ANODIC STRIPPING VOLTAMMETRY,
New Hampshire Univ., Durham. Dept. of Chemistry.
G. A. Bhat, and J. H. Weber.
Analytica Chimica Acta, Vol 141, p 95-103, 1982. 3 Fig, 1 Tab, 20 Ref.

Descriptors: *Anodic stripping voltammetry, *Cadmium, *Fulvic acid, Organic compounds, Chemical analysis, Water analysis, Soil chemistry, Pollutant identification.

The anodic stripping voltammetry technique has been extended to cadmium-soil fulvic acid binding. Evidence is presented for the initial formation of labile complexes and subsequently of moderately labile complexes. Titrations of aqueous solutions of soil fulvic acid with cadmium ion solutions at pH 6 and 7 reveal unusual shapes in the stripping current vs total cadmium ion curves. The expected inflections occur in the titration curves at specific points. The initial rapid increase in current is attributed to labile cadmium-fulvic acid complexes that contribute to the stripping current by rapid dissociation. Subsequent addition of cadmium ion results in moderately labile complexes, and the stripping current becomes partially kinetically controlled. The stripping current was corrected for kinetic current contributions from dissociation of complexes, and total ligand concentrations, conditional stability constants, and upper slopes were calculated from data well past the titration end-point. The use of upper slopes after kinetic current corrections as in situ calibration curves allowed calculations of equilibrium cadmium concentrations. The data show that both kinetic current corrections and in situ calibration curves are needed to avoid substantial errors in calculations of equilibrium cadmium concentrations from anodic stripping voltammetric experiments. (Baker-FRC)
W83-02011

AUTOMATED DETERMINATION OF NITRATE IN WATERS WITH A REDUCTION COLUMN IN A MICROCOMPUTER-BASED STOPPED-FLOW SAMPLE PROCESSING SYSTEM,
Illinois Univ. at Urbana-Champaign. School of Chemical Sciences.
M. A. Koupparis, K. M. Walczak, and H. V. Malmstadt.
Analytica Chimica Acta, Vol 142, p 119-127, 1982. 5 Tab, 33 Ref.

Descriptors: *Water analysis, *Pollutant identification, *Nitrates, Chemical analysis, Computers, Interference, Cyanide, Dichromates, Iodides, Sulfides, Copper, Tin.

An automated method for the determination of nitrate in waters with a microcomputer-based stopped-flow mixing system is described. Nitrate is reduced to nitrate with a copperized cadmium-silver alloy or cadmium tube column fitted to the stopped-flow system. Nitrite is determined using fast kinetic, multi-point or single-point procedures with N-(1-naphthyl)ethylenediamine dihydrochloride as the color reagent. Reduction time parameters are evaluated and optimized. Water samples in the range of 0.025-3 ppm nitrate-nitrogen can be processed with a throughput of up to 100 samples per hour and a detection limit of 0.013 ppm. Interference studies show that cynanide, dichromate, iodide, sulfide, copper and tin ions cause negative results. (Baker-FRC)
W83-02012

DETERMINATION OF MOLYBDENUM IN NATURAL WATERS AFTER SELECTIVE ADSORPTION ON SEPHADEX GEL,
Kyushu Univ., Fukuoka (Japan). Dept. of Chemistry.
K. Yoshimura, S. Hiraoka, and T. Tarutani.
Analytica Chimica Acta, Vol 142, p 101-107, 1982. 4 Fig, 3 Tab, 14 Ref.

Descriptors: *Water analysis, *Atomic absorption spectrometry, *Molybdenum, Natural waters, Natural streams, Lakes, Rivers, Chemical analysis, Spectrophotometry, Pollutant identification.

Molybdenum (VI) ions are adsorbed on Sephadex G-25 gel at pH 3.5, and are desorbed reversibly with a complexing agent, EDTA. The adsorbability is much greater than that for boron (III) and vanadium (V). Large amounts of sodium chloride have little effect on the adsorption. Molybdenum concentrations in natural waters, especially in seawater, can be determined with good precision and accuracy after selective preconcentration of molybdenum by a Sephadex G-25 gel column. The detection limit for 250-ml water samples is about 1 microgram/liter by atomic absorption spectrometry or by spectrophotometry with bromopyrogallol red as reagent. (Baker-FRC)
W83-02013

DETERMINATION OF ARSENIC AND ANTIMONY IN GEOLOGICAL MATERIALS AND NATURAL WATERS BY COPRECIPITATION WITH SELENIUM AND NEUTRON ACTIVATION-GAMMA-SPECTROMETRY,
Dalhousie Univ., Halifax (Nova Scotia). Trace Analysis Research Centre.
C. M. Elson, J. Milley, and A. Chatt.
Analytica Chimica Acta, Vol 142, p 269-275, 1982. 1 Tab, 20 Ref.

Descriptors: *Water analysis, *Neutron activation analysis, *Spectrometry, *Arsenic, *Antimony, Pollutant identification, Natural waters, Natural streams, Lakes, Rivers.

A simple, quantitative method for collecting arsenic and antimony from the digests of geological materials and from salt and fresh waters is described. The procedure involves the addition of selenium(IV) to an acidified sample followed by precipitation of selenium by tin(II) chloride. The precipitate is collected, dried, and irradiated. Arsenic and antimony are quantified directly from the activities of As-76 and Sb-122, respectively. The method has detection limits of 9 ng As and 12 ng Sb per of rock or 500 g of water, and has been applied to eight new reference standards from the US geological Survey. Gold is quantitatively collected by the same procedure. (Baker-FRC)
W83-02014

DETERMINATION OF CHEMICAL OXYGEN DEMAND OF WASTEWATERS WITHOUT THE USE OF MERCURY SALTS,
Southern Water Authority, St. Leonards (England). East Sussex Water and Drainage Div.
D. Ballinger, A. Lloyd, and A. Morrish.
Analyst, Vol 107, No 1278, p 1047-1053, September, 1982. 1 Fig, 3 Tab, 16 Ref.

Descriptors: *Chemical oxygen demand, *Wastewater treatment, *Silver nitrate, Mercury, Sulfates, Chlorides, Water analysis, Wastewater analysis, Pollutant identification.

The use of silver nitrate solution to suppress chloride interference in the chemical oxygen demand test is described. Chlorides in wastewater are precipitated as silver chloride, and in this form are only slightly oxidized. The proposed procedure obviates the use of toxic mercury(II) sulfate and is similar to the standard procedure in accuracy and reproducibility of results over a wide range of chloride concentrations. Good agreement with the standard procedure is obtained for samples containing up to 1000 mg/liter of chloride or with a chloride to COD ratio of 3 to 1 or less. Data has also been presented to show that satisfactory agreement may also be possible for chloride to COD ratios of up to 5 to 1. Above this ratio the standard and proposed procedures produce results that are significantly affected by chloride. (Baker-FRC)
W83-02015

ACUTE TOXOCITY OF ORGANIC EXTRACTS OF MUNICIPAL SEWAGE SLUDGE IN MICE,
New York State Coll. of Veterinary Medicine, Ithaca.
For primary bibliographic entry see Field 5C.
W83-02023

MEASUREMENT OF LOW LEVELS OF MOLYBDENUM IN THE ENVIRONMENT BY USING AQUATIC INSECTS,
Western State Coll. of Colorado, Gunnison.
T. Colburn.
Bulletin of Environmental Contamination and Toxicology, Vol 29, No 4, p 422-428, 1982. 2 Fig, 1 Tab, 11 Ref.

Descriptors: *Molybdenum, *Bioassay, *Aquatic insects, Fate of pollutants, Pollutant identification, Bioaccumulation, Accumulation, Gunnison River, *Colorado, Metals.

Aquatic insects collected in the vicinity of the Gunnison River, Colorado, molybdenum lode had Mo concentrations consistent with the geographical location of sampling. Levels varied with the insect species at the same location and were lowest (about 0.20 ppm) at the most upstream and downstream stations. Highest levels were 1.18-1.40 ppm at the site closest to the mine. No Mo was detected in any water samples (detection limit 1 microgram per liter) even after a 40-fold concentration. Water-insect-Mo data can be useful in studying the fate of low levels of Mo pollutants and as tool in Mo prospecting. (Cassar-FRC)
W83-02027

HIGH PERFORMANCE LIQUID CHROMATOGRAPHIC DETERMINATION OF DIFENZOQUAT RESIDUES IN WATER,
Alberta Environmental Center, Vegreville.
I. Ahmad.
Journal of the Association of Official Analytical Chemists, Vol 65, No 5, p 1097-1101, September, 1982. 6 Fig, 1 Tab, 6 Ref.

Descriptors: *Chromatography, *Water analysis, *Difenzoquat, Herbicides, Agricultural chemicals, Organic compounds, *Pollutant identification, Chemical analysis.

A procedure is described for the quantitative determination of difenzoquat residues in water. The method is quick, simple and reliable and permits rapid monitoring of difenzoquat in water. The method involves high performance liquid chromatography with ultraviolet detection at 255 nm. The procedure is used to determine 2 ppb to 1 ppm levels of difenzoquat in pure and tap water. Samples which contain more than 50 ppb difenzoquat

are injected directly into the liquid chromotograph without prior separation, concentration, or purification. Samples containing less than 50 ppb difenzoquat are first enriched on C18 Sep-Pak reverse phase cartridges and then injected into the liquid chromatograph. Average recoveries of difenzoquat were greater than 92%, with a coefficient of variation less than 4.5%. The method can be used for water samples with difenzoquat concentrations as low as 2 ppb. (Baker-FRC)
W83-02029

DETECTING AN ALGAL TOXIN BY HIGH-PRESSURE LIQUID CHROMATOGRAPHY,
Hong Kong Polytechnic, Kowloon. Dept. of Civil and Structural Engineering.
S. H. Wong, and E. Hindin.
Journal of the American Water Works Association, Vol 74, No 10, p 528-529, 1982. 3 Fig, 2 Tab, 7 Ref.

Descriptors: *Pollutant identification, High performance liquid chromatography, *Algal toxins, *Separation techniques, Bioassays, Water analysis, Toxins, *Chromatography, Organic compounds, Anabaena.

Human gastrointestinal, neurological, respiratory, and allergenic disorders have been reported due to the contamination of drinking water supplies by suspected algal exo- or endo-toxins. Bioassays by small mammals, in the past, have been the only method of detecting the endotoxin, anatoxin-a, produced by Anabaena flos-aquae strain NRC-44-1. A method is decribed for the isolation, detection and quantification of anatoxin-a by high-pressure liquid chromatography (HPLC) with ultraviolet (UV) detection. The endotoxin was isolated from freeze-dried algae by the Devlin method and purified by extraction with chloroform and acidified methanol. HPLC analysis was performed on both a C18 reverse phase column and a Silica-A normal phase column. Fractions of the eluants were collected for six runs and were pooled before bioassay tests of each fraction in mice. Spectrophotometric measurements of anatoxin-a were made at 227 nm. Results showed that the fraction corresponding to the third peak separated on either column gave the same neurotoxic effect on the test animals as that reported for anatoxin-a. Both HPLC columns gave excellent separation at 55 degrees and could be used for isolating and analyzing the nonpurgeable and non-volatile natural organic compounds in water. (Geiger-FRC)
W83-02033

DETERMINATION OF POLYNUCLEAR AROMATIC HYDROCARBONS IN INDUSTRIAL AND MUNICIPAL WASTEWATERS,
Battelle Columbus Div., OH.
P. E. Strup.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-258799, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S4-600-82-025, September 1982. 5 p, 1 Fig, 3 Tab.

Descriptors: *Wastewater analysis, *Hydrocarbons, *Aromatic compounds, *Liquid chromatography, Industrial wastewater, Municipal wastewater, Fly ash, Sample preservation.

A method for the determination of 16 polynuclear aromatic hydrocarbons (PAH) in wastewater was developed. These 16 PAH were: acenaphthene: benzo(ghi)perylene; fluorene; phenanthrene; dibenzo(ah)anthracene; ideno(1,2,3-cd)pyrene; acenaphthalene; anthracene, benzo(a)anthracene, benzo(a)pyrene; benzo(b)fluoranthene; benzo(k)fluoranthene; chrysene; fluoranthene; naphthalene; and pyrene. This method, based on the use of high performance liquid chromatography with ultraviolet and fluorescence detection, is readily suited for detection of condensed ring aromatics in many types of aquenos samples. Aqueous sources included in this study were flyash wash water, municipal sewage, and industrial effluent samples. Precision and accuracy of the method were estimated from the results of five wastewater samples spiked at levels between 0.1 and 250 ppb for the various PAH compounds. Recoveries were generally 85% or better from these wastewater sources. Storage of several spiked wastewater samples for zero and seven days at various temperatures, pH and chlorine levels, resulted in a matrix of recovery data for the various PAH species. These data indicated that the highest recovery for PAH in wastewater are obtained at a pH species. These data indicated that the highest recovery for PAH in wastewater are obtained at a pH level near 7, in the absence of any chlorine with the analysis being completed as soon after collection as possible. (Moore-SRC)
W83-02038

APPLICATION OF EPA METHOD 610 TO THE ANALYSIS OF POLYNUCLEAR AROMATIC HYDROCARBONS IN LEACHATE SAMPLES,
Environmental Monitoring and Support Lab.-Cincinnati, OH.
D. L. Foerst, B. A. Froning, and T. A. Bellar.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-221235, Price codes: A02 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S4-82-041, August 1982. 4 p, 2 Tab.

Descriptors: *Hydrocarbons, *Aromatic compounds, *Leachates, *Sanitary landfills, Landfills, Water analysis, Gas chromatography, Mass spectrometry.

EPA Method 610 was designed for the analysis of 16 polynuclear aromatic hydrocarbon (PNA) compounds in municipal and industrial discharges. Fifteen PNAs were dosed into a sanitary landfill leachate and analyzed using EPA method 610. The PNAs containing two, three, or four fused rings gave recoveries greater than 50%. Those PNAs containing five or six fused rings gave recoveries less than 50%. The leachate matrix was also analyzed by gas chromatography/mass spectrometry (GC/MS) to identify the compounds present in this complex matrix. Forty-three compounds were given a tentative or confirmed identification, but there were 65 additional compounds present in the leachate that could not be identified. Since these leachate samples exhibit a serious matrix effect of low recovery for PNA compounds containing five and six fused rings, further research must be performed to improve the accuracy of the analytical method for measuring the high molecular weight PNA compunds in landfill leachates. (Moore-SRC)
W83-02043

THE CHARACTERIZATION OF THE CHESAPEAKE BAY: A SYSTEMATIC ANALYSIS OF TOXIC TRACE ELEMENTS,
National Bureau of Standards, Washington, DC.
H. M. Kingston, R. R. Greenberg, E. S. Beary, B. R. Hardas, and J. R. Moody.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-265265, Price codes: A10 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S3-82-085, October 1982. 3 p, 1 Ref.

Descriptors: *Trace elements, *Chesapeake Bay, *Water chemistry, Estuarine environment, Particulates, Neutron activation analysis, Atomic absorption spectroscopy, Toxic substances, Heavy metals.

As part of a multidisciplinary study of Chesapeake Bay, techniques and procedures were developed to measure trace and toxic element concentrations within the water column throughout the length of Chesapeake Bay. The analysis has been completed for selected elements (Cd, Ce, Co, Cr, Cu, Fe, Mn, Mo, Ni, Pb, Sc, Sn, Th, U, and Zn), including some elements at concentrations consistently below one picogram per milliliter. The first stage of study included the developement and construction of a sampling system for the trace metallic elements dissolved in water and filtration system for collecting the particulate elemental component. The second phase consisted of sampling chemical stabilization by acidification and storage of the samples in the field. The total complement of 102 samples was obtained, filtered, acidified, and stabilized. The third major phase consisted of the chemical separation and preparation of samples for the analytical instrumental methods. The fourth major phase consisted of the instrumental analysis of the samples for the trace elements using neutron activation analysis and atomic absorption spectrometry. The fifth major phase involved data reduction and atomic absorption spectrometry. The fifth major phase involved data reduction and evaluation of the statistical significance of blanks. (Moore-SRC)
W83-02044

METHOD DEVELOPMENT FOR DETERMINATION OF POLYCHLORINATED HYDROCARBONS IN MUNICIPAL SLUDGE,
Southwest Research Inst., San Antonio, TX.
C. F. Rodriguez, W. A. McMahon, and R. E. Thomas.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-234071, Price codes: A04 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S4-82-035, September 1982. 5 p, 1 Tab.

Descriptors: *Chlorinated hydrocarbons, *Polychlorinated biphenyls, *Halogenated pesticides, *Sludge, DDT, DDE, DDD, Dieldrin, Endrin, Aldrin, Electron capture gas chromatography, Gas Chromatography, Mass spectrometry.

The methodology developed for analysis for chlorinated pesticides and biphenyls consists of extraction of the polychlorinated compounds by liquid-liquid partitioning, cleanup by removal of some interferences by liquid chromatographic column and by precipitation of sulfur with mercury, concentration by evaporation of the extracting solvent, detection and quantification by electron capture gas chromatography, and confirmation of identity by gas chromatography/mass spectrometry. The 17 chlorinated organic compound formulations studied were divided into five groups. Group I was made up of alpha-, beta-, and delta-BHC, p,p'-DDE, p,p'-DDD, p,p-'DDT and heptachlor epoxide. Group II included the compounds gamma-BHC, aldrin, endosulfan I and II, dieldrin, endrin and its aldehyde, and heptachlor. The multicomponent formulation, chlordane, makes up Group III and Group IV is made up of many compounds which together constitute the pesticide toxaphene. Group V was made up of Aroclor 1260, a formulation of a number of polychlorinated biphenyls. The methodology provides a sound basis for the determination of polychlorinated biphenyls and organochlorine pesticides in municipal sewage treatment facilities. The detection limit attained by application of the methodology to a number of different sludges was 0.3 micro g of each single component pesticide per gram of dry sludge and 3 to 15 micro g per gram dry sludge for the multicomponent polychlorinated formulations studied, chlordane, toxaphene, and Aroclor 1260. (Moore-SRC)
W83-02045

APPLICATION AND EVALUATION OF ANALYTICAL PROCEDURES FOR TRACE METALS, TOTAL CYANIDE AND PHENOLICS,
Biospherics, Inc., Rockville, MD.
G. J. Gottfried.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-218512, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S4-82-001, August 1982. 3 p. 68-03-2788.

Descriptors: *Trace metals, *Phenols, *Cyanide, *Industrial wastewater, *Wastewater analysis, *Effluents, *Sample preservation, Trace elements, Spectral analysis, Colorimetry.

Analytical procedures for the determination of trace metals, total cyanide, and phenolics were systematically evaluated in a wide variety of industrial effluents to assess their industry-wide applicability. Matrix interferences, methods equivalency, and analytical precision were investigated through

a series of duplicate and spiked analyses on non-diluted and diluted samples. Validation of the methodologies and identification of their limitations were thus established both within specific industrial classifications and across multiple industrial processes. Direct flame aspiration produced the most reliable results of any atomic absorption technique. Graphite furnace and chelation/extraction procedures generally produced reliable results but were more susceptible to matrix effects than direct flame aspiration. Graphite furnace and sodium borohydride hydride generation methods for arsenic and selenium proved acceptable, whereas zinc slurry hydride generation suffered from losses during digestion. The three phenolic methods tested were not equivalent and only 4-AAP colorimetric produced reasonable results. The MBTH colorimetric and instrumental methods were limited by severe matrix interferences or high background signals. The pyridine pyrazolone and pyridine barbituric acid methods for total cyanide produced equivalent results and generally reliable data. Holding times for phenolics and cyanides can be increased from 24 hr to 10 days based on preservation studies. (Moore-SRC)
W83-02047

APPLICATION OF METHODS 606 AND 608 FOR ANALYSIS OF PCBS, ORGANOCHLORINE PESTICIDES AND PHTHALATE ESTERS CONTAINED IN LANDFILL LEACHATES,
Environmental Monitoring and Support Lab.-Cincinnati, OH.
T. A. Bellar, and B. A. Froning.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-227463, Price codes: A02 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S4-82-044, August 1982. 4 p, 3 Tab.

Descriptors: *Halogenated pesticides, *Phthalate esters, *Polychlorinated biphenyls, *Leachates, *Water analysis, *Sanitary landfills, Pesticides, Electron capture gas chromatography, Landfills, Ohio.

Methods 606 and 608 are liquid/liquid extraction electron capture gas chromatography methods for the determination of polychlorinated biphenyls (PCBs), organochlorine pesticides and phthalate esters contained in industrial and municipal wastewaters. In order to determine if these procedures are applicable to the determination of priority pollutants in landfill leachates, samples were collected from a large sanitary landfill located in Hamilton County, Ohio. The landfill leachate contained a complex mixture of extractable chemical compounds. Analysis of such extracts without column clean up will irreversibly damage the gas chromatography column. Leachates were spiked with various priority pollutants, and tested by the application of methods 606 and 608. For method 606, recoveries in excess of 70% should be expected with poor relative standard deviation (RSD) for duplicate analyses. At concentrations in excess of 0.5 micro g/l, method 608 worked well for the pesticides tested. Poor recoveries, 30 to 40% less than those for reagent water spikes, were noted for the PCBs. The reason for the poor recovery is as yet unknown. (Moore-SRC)
W83-02048

SOURCES OF PCBS TO WISCONSIN LAKES,
Wisconsin Univ.-Madison. Dept. of Water Chemistry.
D. E. Armstrong, and D. L. Swackhamer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-167890, Price codes: A02 in paper copy, A01 in microfiche. Water Resources Center Technical Report WIS WRC 82-04, Wisconsin University, Madison, 1982. 17 p, 1 Fig, 3 Tab, 36 Ref. OWRT A-084-WIS(1), 14-34-0001-0153.

Descriptors: *Atmospheric pollution, *Lakes, *Water pollution sources, *Polychlorinated biphenyls, Bottom sediments, Fish, *Lake sediments, Model studies, *Sediment analysis, Sediments, *Wisconsin, air pollution, Great Lakes.

The accumulation of polychlorinated biphenyls (PCBs) in Great Lakes fishes has focused attention on the sources of PCBs to the Great Lakes. PCBs are transported in part by air, but the relative importance of atmospheric as compared to tributary and industrial sources is uncertain. Direct measurement of PCB inputs to the Great Lakes is difficult because of the large number of potential tributary and industrial point sources and the problems associated with modeling atmospheric input from measured concentrations of PCBs in air. In the Great Lakes region many lakes can receive PCB input only from atmospheric sources. In particular, seepage lakes located in remote areas are unlikely to receive PCBs from industrial point sources or surface drainage. The purpose of this investigation was to evaluate the importance of atmospheric versus non-atmospheric sources of PCBs to Lake Michigan by comparing Lake Michigan with lakes located in remote areas. PCB concentrations in the surface sediments were compound. This project focused on developing accurate methods for measuring PCBs in lake sediments and obtaining preliminary data on PCB concentrations in contrasting lakes. This report summarizes the method for PCB analysis developed and the preliminary lake sediment data.
W83-02059

APPLICATION OF ELECTROCHEMICAL DETECTORS FOR IMPROVED SENSITIVITY IN HIGH PERFORMANCE LIQUID CHROMATOGRAPHIC SEPARATION AND QUANTITATION OF ULTRATRACE,
Georgia Univ., Athens. Dept. of Chemistry.
J. L. Anderson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-168005, Price codes: A03 in paper copy, A01 in microfiche. Georgia Institute of Technology, Environmental Resources Center Report Number ERC 03-82, Atlanta, July 1982. 34 p, 6 Fig, 2 Tab, 29 Ref. OWRT A-090-GA(1), 14-34-0001-1111.

Descriptors: *Carbamate pesticides, *Pesticides, *Urea pesticides, *Coal phenolic residues, *Electrochemical detectors, High performance liquid chromatography, Kelgraf electrode, *Chromatography, *Pollutant identification.

Electrochemical detectors based on a Kel-F-graphite ('Kelgraf') composite working electrode material were developed and applied for liquid chromatographic detection of selected pesticides in the carbamate and urea classes at ultratrace levels in water. Detection limits as low as 50 picograms were achieved for selected carbamate pesticides including Aminocarb and Carbendazim in river water. These detection limits are markedly superior (typically at least 20-fold) to values reported to date by other workers for electrochemical or any other detectors for liquid chromatography. In general, species electrochemically oxidizable with formal potentials less than + 1.1 V vs. Ag/AgCl exhibit detection limits in the subnanogram range. Work on characterization of the Kelgraf electrode revealed that its microparticulate surface structure with islands of graphite active sites surrounded by Kel-F plays an important role in minimizing interference from solvent oxidation current fluctuations, enabling very favorable detection limits to be achieved at the very positive applied potentials used in this work. The electrode structure shows promise for improving detection limits for a wide range of analytes including many not investigated here. A very effective, rapid approach was developed and tested for off-line estimation from a single cyclic voltammogram of the optimum applied potential for an electrochemical flow detector under chromatographic conditions. An improved electrochemical cell design was developed and tested for rapid kinetic measurements on electrochemical systems of interest.
W83-02070

TRACE ENRICHMENT OF FLUORINATED ORGANIC ACIDS USED AS GROUND-WATER TRACERS BY LIQUID CHROMATOGRAPHY,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
K. J. Stetzenbach, S. L. Jensen, and G. M. Thompson.
Environmental Science and Technology, Vol 16, No 5, p 250-254, 1982. 5 Fig, 1 Tab, 15 Ref.

Descriptors: *Environmental tracers, *Sample preparation, *Fluorine, Groundwater pollution, *Pollutant identification, *Organic acids, *Chromatography, *Aromatic compounds.

A group of fluorinated aromatic organic acids are used to trace groundwater flow and to monitor waste disposal sites. Current methods for analyzing these organic acids using bonded-phase high-performance liquid chromatrography provide good measurement capability only in the 0.1 to 1.0 parts per million range. A method has now been developed for concentrating the fluorinated aromatic organic acids used as tracers to allow detection at the low parts per billion level while maintaining the ease and precision typical of high-performance liquid chromatography analysis. The currently-used injection-valve sample loop was replaced with a 3-centimeter column packed with an octadecylsilane bonded phase, allowing tracer to be extracted from a large water sample as it is pumped through the injection valve. Tests of this method of sample enrichment for analysis of m-(trifluoromethyl)-benzoic acid, pentafluorobenzoic acid, and benzoate demonstrated that the procedure was rapid, simple, and efficient. For compounds that partition strongly into a hydrocarbon phase, very large concentrating volumes, which result in an increased sensitivity of three or more orders of magnitude, can be used. (Carroll-FRC)
W83-02073

LIQUID CHROMATOGRAPHY WITH PRECOLUMN SAMPLE PRECONCENTRATION AND ELECTROCHEMICAL DETECTION: DETERMINATION OF AROMATIC AMINES IN ENVIRONMENTAL SAMPLES,
Purdue Univ., Lafayette, IN. Dept. of Chemistry.
J. R. Rice, and P. T. Kissinger.
Environmental Science and Technology, Vol 16, No 5, p 263-268, 1982. 6 Fig, 1 Tab, 9 Ref.

Descriptors: *Environmental tracers, *Sample preparation, *Aromatic compounds, *Pollutant identification, Water pollution, *Chromatography.

Methods currently approved by the Environmental Protection Agency for the preparation of environmental samples containing amine-substituted aromatic compounds have several significant shortcomings. An analytical methodology has been developed which represents a distinct improvement in the technology available for the determination of these pollutants, as well as for many hydrophobic phenols and cresols. The procedure described involves simple filtration of a raw aqueous sample, utilization of a large volume of this for column preconcentration of analytes of interest, separation of these components by reversed-phase liquid chromatography, and quantitation by electrochemical detection. This technique was applied to environmental samples containing low concentrations of the following toxic aromatic amine pollutants: benzidine, 3,3'-dimethoxybenzidine, 4-aminobiphenyl, 3,3'-dichlorobenzidine (DCB), and 4,4'-methylenebis(2-chloroaniline) (MOCA). A complete analytical procedure is described for the determination of benzidine and for 3,3'dimethoxybenzidine, with linearity demonstrated for benzidine added to river water from 25 pg/ml to 5 ng/ml. The limit of detection was found to be 5 pg/ml. More rigorous chromatographic conditions were utilized to determine the other three compounds. Groundwater samples and soil core samples known to contain benzidine and 3,3'-dichlorobenzidine were successfully studied using this approach. No interferences with the amines of interest were observed. (Carrol-FRC)
W83-02092

A NOVEL INTEGRATIVE TECHNIQUE FOR LOCATING AND MONITORING POLYNUCLEAR AROMATIC HYDROCARBON DISCHARGES TO THE AQUATIC ENVIRONMENT,
Roswell Park Memorial Inst., Buffalo, NY.
J. J. Black, T. F. Hart, Jr., and P. J. Black.
Environmental Science and Technology, Vol 16, No 5, p 247-250, 1982. 5 Fig, 22 Ref.

Descriptors: *Hydrocarbons, *Water pollution sources, *Monitoring, *Pollutant identification, Substrates, Water analysis, Organic compounds, Chromatography, Sample preparation, *Polynuclear aromatic hydrocarbons, Niagara River, Lake Erie, On-site tests, Path of pollutants, *New York.

A simple, relatively inexpensive analytical technique has been developed for use in locating and integrative monitoring of polynuclear aromatic hydrocarbons in aquatic environments. Polypropylene cut from a commercial oil-adsorbant cloth (3M Brand Oil Sorbant Type 151) were anchored at ten sites on the Niagara River and Lake Erie near suspected sources of polynuclear aromatic hydrocarbon discharges. Mild ethanolic extraction and liquid-liquid partitioning are used to isolate a polynuclear aromatic hydrocarbon containing fraction which is amenable to analysis by high-pressure liquid chromatography. This technique provides an integrated record of the accumulation of polynuclear aromatic hydrocarbons over the time of field exposure. Although efficiencies of the extraction method were in the low range for some of these hydrocarbon compounds, the reproducibility of the substrate technique was excellent. The technique can be used for rapid tracking of these hydrocarbons to their putative sources, followed by more detailed monitoring of specific effluents to determine actual discharge rates. (Carrol-FRC)
W83-02093

5B. Sources Of Pollution

MERCURY AND OTHER HEAVY METALS IN THE WATER: MIGRATION, ACCUMULATION, AND TOXICITY TO AQUATIC ORGANISMS (A REVIEW),
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
F. Ya. Komarovskiy, and L. R. Polishchuk.
Hydrobiological Journal, Vol 16, No 5, p 51-62, 1981, 1 Tab, 115 Ref.

Descriptors: *Heavy metals, *Mercury, *Biological magnification, *Water pollution sources, *Water pollution effects, *Toxicity, *Fate of pollutants, *Literature review, Bioaccumulation, Aquatic populations, Industrial wastes, Bottom sediments, *Reviews, Fungicides.

Heavy metals are dangerous contaminants of natural waters, since they may poison aquatic organisms even at very low concentrations. Sources of heavy metals input into natural water are direct runoff of industrial effluents and transfer of air pollutants to water. Heavy metals may be biologically magnified through the food chain. Some concentrations of mercury (Hg) that have been recorded in freshwater and marine organisms are tabulated. Sources of Hg discharge into water are by industrial effluents, fungicides and by natural sources. Hg concentrates more intensively in aquatic ecosystems than in land systems. Some toxic effects of Hg and Hg compounds are reviewed. Many models for methylmercury accumulation in the food web have been proposed. Some levels of accumulation of heavy metals in bottom sediments are discussed. To define the maximum permissible levels of these metals, it is essential to take into account various factors affecting their toxicity, such as organic content, dissolved oxygen pH, water hardness and temperature. More studies on the migration and accumulation of heavy metals in water, aquatic organisms and sediments are needed to ascertain possible immediated and long term effects on biotic and abiotic components of the environment. In the meantime, the influx of heavy metals into the aquatic environment must be strictly curtailed. (Geiger-FRC)
W83-01755

FLUX OF ALIPHATIC AND POLYCYCLIC AROMATIC HYDROCARBONS TO CENTRAL PUGET SOUND FROM SEATTLE (WEST-POINT) PRIMARY SEWAGE EFFLUENT,
Washington Univ., Seattle. Coll. of Ocean and Fishery Sciences.
R. C. Barrick.
Environmental Science and Technology, Vol 16, No 10, p 682-692, October 1982, 2 Fig, 5 Tab, 45 Ref.

Descriptors: *Hydrocarbons, *Wastewater pollution, *Storm wastewater, Primary wastewater treatment, Wastewater treatment, *Aliphatic hydrocarbons, *Aromatic hydrocarbons, *Polynuclear aromatic hydrocarbons, Municipal wastewater, Seattle, *Washington, *Puget Sound, Storm runoff, Runoff, Combined sewer overflows, Fallout, Water pollution sources, Fate of pollutants, Alkanes, Urban runoff.

Primary municipal wastewater discharging into Puget Sound from the METRO sewage treatment facility at West Point (Seattle), Washington, contributed 475 metric tons per year of aliphatic hydrocarbons and 1 metric ton per year of 3-7 ring polynuclear aromatic hydrocarbons (PAH). This corresponded to a per capita loading of 2.6 g and 0.005 g per day, respectively. The ratio of particulate to dissolved aliphatic hydrocarbons was 4:1. Both fractions had similar compositions, with n-alkanes of C22 or less dominating. Isoprenoid alkanes, n-alkyl cyclohexanes, steroid hydrocarbons, tri- and diterpenoid hydrocarbons, and unidentified C21-C32 branched alkanes were also found. The major source of the aliphatic hydrocarbons was undergraded fuel oils. Aromatic hydrocarbons were dominated by phenanthrene and its methyl and dimethyl derivatives (particulate fraction) and 1,1'-biphenyl-3-o1 (dissolved fraction). A major source of the PAH compounds was street runoff, which contains dust, road wear particles, and automotive oil and grease. The municipal wastewater constituted 2/3 of the total aliphatic hydrocarbon discharging into Puget Sound. Other sources were combined sewer overflows, urban runoff, atmospheric fallout, and discrete discharges from ships and industries. Although PAH inputs are less well defined, municipal wastewater is an important source as well as storm water and combined sewer overflows and atmospheric fallout. In Puget Sound surface sediments accumulations of resolvable alkanes were negligible; phenanthrene plus an unresolved complex mixture, partial; and PAH of 4 or more, substantial. (Cassar-FRC)
W83-01762

CHROMIUM IN WATER, SUSPENDED PARTICLES, SEDIMENTS AND BIOTA IN THE IRAJA RIVER ESTUARY,
Universidade Federal do Rio de Janeiro (Brazil). Inst. de Biofisica.
W. C. Pfeiffer, M. Fiszman, L. D. De Lacerda, M. van Weerelt, and N. Carbonell.
Environmental Pollution, Series B, Vol 4, No 3, p 193-205, 1982. 1 Fig, 7 Tab, 14 Ref.

Descriptors: *Fate of pollutants, *Chromium, *Bioindicators, *Estuaries, *Bays, *Bottom sediments, *Biological magnification, *Barnacles, Heavy metals, Indicators, Suspended solids, Suspended sediments, Monitoring, *Brazil, Iraja River estuary, Guanabara Bay, Pollutant identification, Outfalls, Spectrophotometry.

The levels of chromium (Cr) in samples of water, suspended particles, bottom sediments, fish (Poecilia reticulata), plants (Paspalum vaginatum, sesuvium portulacastrum, Philoxeros vermicularis), soils, and barnacles (Balanus sp) collected from August 1976 to September 1980 from the Iraja River and its estuary were measured. Sediment and water samples from the Iraja River had Cr levels a thousand times greater than the published data for freshwater systems. Cr was carried by particulate matter to Guanabara Bay. Cr from water of sediments was concentrated by fish and emergent grass and returned to the system as detritus. The vegetal community displayed a concentration factor smaller than that of soil and prevented the return of Cr to the waters of the estuary. Balanus sp. of the Guanabara Bay concentrates Cr in soft tissues 1000 times higher than values found in suspended particles, and may be used as a biological monitor for this heavy metal in estuarine systems. (Geiger-FRC)
W83-01764

MIGRATION OF 1,1,1-TRICHLOROETHANE IN SOIL,
Parma Univ. (Italy). Inst. of Organic Chemistry.
G. P. Gardini, and M. Copelli.
Chemosphere, Vol 11, No 9 p 921-924, September, 1982. 2 Fig, Ref.

Descriptors: *Chlorinated hydrocarbons, *Solvents, *Industrial wastes, Milan, *Italy, *Trichloroethane, Fate of pollutants, Path of pollutants, Organic compounds, Spills.

An industrial plant at Milan. Italy, using large quantities of 1,1,1-trichloroethane (TCE), was investigated to determine the extent of soil contaminated by spillage on the surface and storage in underground concrete tanks. Samples were collected on the surface, in the waste solvent tanks, and in boreholes up to 20 m deep. The maximum depth of TCE penetration was 7 m, in spite of concentrations of 32 ppm TCE directly under the concrete floor. The solvent traveled through the soil mainly in vertical direction, with limited cross-sectional diffusion. Clay layers wee located at the 2-3 m and 5-6 depths. The diffusion rate was 10 to the minus 5th power to 10 to the minus 6th power cm per sec. Conclusions were: (1) concrete waste solvent tanks did not prevent TCE from entering the soil, and (2) this plant was not responsible for the widespread, severe halocarbon groundwater pollution in the Milan area. (Cassar-FRC)
W83-01773

RELATIVE STABILITY OF CARBARYL IN TROPICAL ECOSYSTEMS,
Ife Univ. (Nigeria). Dept. of Microbiology.
O. Odeyemi.
Environmental Pollution, Series A, Vol 29, No 3, p 207-213, November, 1982. 4 Fig, 12 Ref.

Descriptors: *Fate of pollutants, *Carbamate pesticides, *Carbaryl, *Biodegradation, *Pesticide residues, *Ecosystems, *Pesticides kinetics, Pesticides, Insecticides, Degradation, Microbial degradation, Seawater, Wastewater, *Tropical regions, Colorimetry.

The persistence of the insecticide, carbaryl, in various tropical ecosystems was examined by incubating sterile and non-sterile samples of freshwater, sewage, agricultural soil, and seawater with the chemical at levels of 45 milligrams/kilograms under greenhouse conditions for 9 weeks. The residual pesticide in each sample was extracted at 1 week intervals and assayed colorimetrically. Results showed that carbaryl disappeared in sewage water, agricultural soil, and fresh water samples after 42, 53, and 60 days of incubation, respectively, but only 77% of the insecticide disappeared after 63 days of incubation in sea water. Since carbaryl generally disappeared more rapidly in non-sterile than in sterile samples from each ecosystem, the degradation of the pesticide is thought to be partly biological as well as chemical. (Geiger-FRC)
W83-01776

MOBILITY AND BIOAVAILABILITY OF URANIUM MILL TAILINGS CONTAMINANTS,
Los Alamos National Lab., NM.
D. R. Dreesen, J. M. Williams, M. L. Marple, E. S. Gladney, and D. R. Perrin.
Environmental Science and Technology, Vol 16, No 10, p 702-709, October, 1982. 6 Tab, 23 Ref.

Descriptors: *Uranium, Metals, *Radioactive wastes, Fate of pollutants, *Mine wastes, Mills, Leaching, Heavy metals, *Trace metals, Sulfides, Vegetation, Irrigation water, Ponds, Radioisotopes, Bioaccumulation, Accumulation, Groundwater pollution, *Colorado, Carson City, *Path of pollutants.

The presence, mobility in water, and bioavailability of toxic contaminants (trace metals and radionuclides) produced at uranium mills were studied in the laboratory and at an active mill site at Canon City, Colorado. Analysis of mill tailings showed enrichment of U and its analogs. Concentration factors (mill tailings/soil) were 880 for U, 250 for V, 67 for Mo, 50 for Se, and 41 for As. Heavy

metals (Cu, Co, Pb, and Ni) and sulfur were less enriched, with concentration factors of 1.7-14; Ra-226 was enriched by 910 times. Aqueous leaching of alkaline tailings mobilized the anionic species As, Mo, Se, and U. Acid tailings leachates contained appreciable Co and Ni. V did not appear to be very water soluble at the pH's encountered. The degree to which each contaminant was mobilized depended on the type of ore and the milling process (acid or carbonate leach, ore roasting, etc.). The extent of migration depended on the strata underlying tailings ponds and the extent of adsorption or precipitation processes. At the active uranium mill, which used the alkaline leach (carbonate) process, Mo and U concentrations in waters and soils were measured at 4 locations plus a distant, unimpacted site. Highest concentrations of metals found in the water samples were 25 mg per liter Mo in the tailings pond area, seepage collection dam, and land irrigated with contaminated groundwater; 5.8 mg per liter U in the seepage collection dam. In the surface soils up to 200 micrograms per g Mo and 73 micrograms per g U were found at the tailings pond. In vegetation (grasses and annuals) the highest metals levels were 190 micrograms per g Mo and 36 micrograms per g U. (Cassar-FRC)
W83-01777

CHLORINATED HYDROCARBONS AND RADIONUCLIDE CHRONOLOGIES IN SEDIMENTS OF THE HUDSON RIVER AND ESTUARY, NEW YORK,
Lamont-Doherty Geological Observatory, Palisades, NY.
R. F. Bopp, H. J. Simpson, C. R. Olsen, R. M. Trier, and N. Kostyk.
Environmental Science and Technology, Vol 16, No 10, p 666-676, October, 1982. 8 Fig, 6 Tab, 36 Ref.

Descriptors: *Chlorinated hydrocarbons, *Radioisotopes, *Pesticides, Fate of pollutants, Path of pollutants, *Polychlorinated biphenyls, *Hudson River, *New York, Sediment cores, Organic compounds, Aroclors, DDD, Dieldrin, Chloridane.

Polychlorinated biphenyls (PCB's), chlorinated hydrocarbon pesticides, and radionuclides were measured in 6 sediment cores taken from the Hudson River in 1977 and 1977 from kilometer point - 2.4 at New York City to kilometer point +230.7 downstream from the Mowhawk River confluence. During 1950-76 several hundred tons of PCB's were discharged from a capacitor manufacturing plant in the upper basin. The Indian Point nuclear reactor is located at km point 69.5. Maximum PCB concentrations occurred in the core sections corresponding to the early 1970's. For example, at the 230.7 km point the maximum PCB levels at the 30-40 cm sediment depth were 140 + or - 39 ppm Aroclor 1242 and 5.92 + or - 0.21 ppm Aroclor 1254. The levels declined to 33.3 + or - 4.0 and 1.81 + or - 0.33 ppm, respectively, in the 0-10 cm layer. In 1973 a retaining dam downstream from the capacitor plant was removed. Since then surface sediment PCB levels have decreased due to burial and dilution of contaminated sediments with soils from the drainage basin. Sediment core analysis also revealed that levels of chlorinated hydrocarbon pesticides (p,p'-DDD, gamma and alpha chlordane, and dieldrin) and radionuclides from fallout have declined since the mid-1960's, reflecting the decrease in use of these pesticides and the halt in atmospheric nuclear testing. Radionuclide concentrations in core sections representing 1971-75 reflected the maximum releases from the nuclear plant in 1971. (Cassar-FRC)
W83-01778

DEPENDENCE OF SORPTION RATES OF RADIONUCLIDES BY FRESHWATER PLANTS ON THE PH OF THE WATER,
Akademiya Nauk SSSR, Sverdlovsk.
M. Ya. Chebotina, and S. A. Lyubimova.
Hydrobiological Journal, Vol 17, No 5, p 84-88, 1981. 4 Fig, 1 Tab, 16 Ref.

Descriptors: Accumulation, *Cesium radioisotopes, *Iron radioisotopes, *Cobalt radioisotopes, *Strontium radioisotopes, *Soil-water-plant relationships, *Hydrogen ion concentration, Trace elements, Iron, Cobalt, Strontium, Cesium, Uptake, Heavy metals, Radioisotopes, Soil water, *Adsorption.

The accumulation of Fe-59, Co-60, Sr-90, and Cs-137 by fresh-water plants and soils was studied as a function of the pH of the water in laboratory tests. The disturbance of the acid-base conditions of the water over a wide pH range had no significant effect on Cs-137 distribution in the water-plant system or the water-soil system, but produced an appreciable effect of Fe-59, Co-60, and Sr-90 distributions in both systems. One of the most likely mechanisms of the pH effect on Sr-90 accumulation is alterations in the carbonate-bicarbonate equilibrium. Variation in pH over a wide range brings about changes in the state of Fe-59 and Co-60 in solution and generates forms differing in mobility and sorptivity in both water-plant and water-soil systems. (Geiger-FRC)
W83-01786

GROUND WATER QUALITY IN SOUTHEASTERN MINNESOTA,
Minnesota Univ., Minneapolis. School of Public Health.
R. D. Singer, M. T. Osterholm, and C. P. Straub.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-15437, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Center Bulletin 109, University of Minnesota, St. Paul, October 1982. 45 p, 13 Fig, 4 Tab, 38 Ref. OWRT A-035-MINN(2).

Descriptors: *Groundwater contamination, *Rural water supply, *Health aspects, Indicators, Well construction, Well location, Waterwells, *Water quality, *Minnesota, Karst.

Water quality of 21 private wells in the karst area of southeastern Minnesota was studied from Feb. 1977 to May 1979. The wells were located within a one-township area and were chosen for study following a questionnaire survey by type of construction and aquifer(s) in which they were completed. Thirteen routine and six runoff samples were collected from each well during the study and were examined for 18 biological, physical and chemical parameters. The parameters measured in samples from wells in the Galena Formation had the most variation with total coliform and nitrate nitrogen concentrations exceeding recommended limits for drinking water in 68 and 72 percent of the samples, respectively. Generally, it was found the median routine concentrations of all parameters studied were lower than the median runoff concentrations. There was evidence that the chemical quality of the water in the deeper aquifers supposedly protected by a major aquitard was affected rapidly by surface runoff. The parameters found to be the best indicators of surface water contamination of the aquifers and therefore indicators of possible health effects as a result of consumption of such were: bacterial counts, nitrate nitrogen, turbidity, conductivity, sulfate, chloride, phosphate, total organic carbon, and sulfate/chloride and nitrate nitrogen/chloride ratios.
W83-01791

DEVELOPMENT OF A METHODOLOGY FOR IDENTIFYING CRITICAL NONPOINT POLLUTION AREAS IN AGRICULTURAL WATERSHEDS,
Marquette Univ., Milwaukee, WI. Dept. of Civil Engineering.
V. Novotny, T. Daniel, and R. Motschall.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-154393, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Center Technical Report WIS WRC 82-03, University of Wisconsin, Madison, 1982. 37 p, 12 Fig, 3 Tab, 45 Ref. OWRT A-082-WIS(1), 14-34-001-0153.

Descriptors: *Agricultural runoff, *Agricultural watersheds, Erosion, *Nonpoint pollution sources, Pollutants, *Sediment transport, Sediment yield, *Wisconsin, *Overland flow, Manure, Waste disposal.

Delivery of sediment and particulate pollutants from diffuse sources is shown to be related to the loss of sediment carrying energy of runoff during the overland flow phase. The loss is caused by the termination of rainfall and by reduction of flow energy during the recession phase of the overland flow hydrograph. Theoretical analyses and experimental measurements have demonstrated that the saturated sediment concentration in overland flow is a function of rainfall erosivity and the runoff flow rate. The hypotheses were verified by field measurements from a small homogeneous watershed. Critical manure management areas (CMMAs) are barnyards and manure disposal areas that are potential contributors to nonpoint pollution. Identifying and ranking a CMMA is a problem for the resource manager involved in solving nonpoint pollution problems on priority watersheds. An ideal method to identify CMMAs must be technically sound, inexpensive, and easy to administer. The goal of this portion of the project was to develop a procedure that identifies CMMAs which drain into intermittent waterways using soil samples.
W83-01793

DISSOLUTION KINETICS OF SURFICIAL MANCOS SHALE-ASSOCIATED ALLUVIUM,
Ben-Gurion Univ. of the Negev, Beersheba (Israel). Dept. of Geography.
J. B. Laronne.
Earth Surface Processes and Landforms, Vol 6, p 541-552, 1981. 4 Fig, 1 Tab, 27 Ref. OWRT B-121-COLO(1), 14-3-001-5061.

Descriptors: *Kinetics, *Alluvium, *Solubility, *Salts, *Sediments, Surface flow, Storm seepage, Arid lands, Saline water, Simulation, Semiarid lands, Equilibrium, Minerals.

Determination of the total quantity of solute production from wildland areas as well as that originating solely from non-point sources is essential in order to ascertain the salinity potential of a given watershed. A laboratory study was undertaken to simulate mineral dissolution in a semiarid, saline environment using highly erodible materials. Functions defining the dissolution rates of saline Mancos Shale-associated alluvium in distilled water follow varying patterns. Dissolution is characterized by an initial high rate constant, by a following phase where rates are reduced drastically, and by a final period of encroachment to equilibrium. Initial dissolution rates increase with increase in salt content and sediment: water ratio. The time necessary to approach equilibrium is found to be directly proportional to the sediment: water ratio. The hydrated sodium and magnesium sulfate minerals provide most of the initial solutes, though not necessarily most of the total solute bulk. Results indicate that the high initial dissolution rate of soluble minerals from alluvium, and particularly from shales in contact with aqueous solutions, is too short-lived to account for most of the solutes occurring in heavily sediment-laden surface flow. Excluding input from slower, usually supersaturated subsurface flow, dissolution from sediment in transport should be a major source of solutes in originally undersaturated and kinetically unequilibrated surface water in semiarid and arid regions. (Moore-SRC)
W83-01841

WATER QUALITY OF THE THREE MAJOR TRIBUTARIES TO THE CHESAPEAKE BAY, THE SUSQUEHANNA, POTOMAC, AND JAMES RIVERS, JANUARY 1979 - APRIL 1981,
Geological Survey, Towson, MD. Water Resources Div.
D. J. Lang.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-238593, Price codes: A04 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 82-32, May 1982. 64 p, 17 Fig, 20 Tab, 21 Ref.

Descriptors: *Water quality, *Data collections, *Water analysis, *Rivers, *Bays, Sampling, Sites, Storms, Stream discharge, Sediment transport, Sediments, Nutrients, Trace metals, Pesticides, *Chesapeake Bay, Susquehanna River, Potomac River, James River, Conowingo Dam, Fall Line.

Water-quality constituent loads at the Fall Line stations of the Susquehanna, Potomac, and James Rivers, the three major tributaries to the Chesapeake Bay, can be estimated with reasonable accuracy by regression techniques, especially for wet periods of 1 year or more. Net transport of all nutrient species and most other constituents is dominated by a few spring and storm-related high-flow events. Atrazine and 2,4-D are the two herbicides most consistently detected at the Fall Line of the Susquehanna and Potomac Rivers. Concentrations of total residual chlorine and low-molecular-weight, halogenated hydrocarbons at selected sites in estuaries to the upper Bay are generally at or below detection limits. Ammonia concentrations and loads are decreasing at all three Fall Line stations, as is orthophosphate in the Susquehanna and Potomac Rivers. Slight increases in total nitrogen and nitrite plus nitrate concentrations in the Susquehanna River from 1969 to 1980 may warrant continued monitoring. Analyses of data for this report confirm the previous suggestion that when water discharge of the Susquehanna River at Conowingo, Maryland, is below about 400,000 cubic feet per second, sediment, with sorbed nutrients and other constituents, is deposited behind the three hydroelectric dams on this river between Harrisburg, Pennsylvania, and its mouth. Discharges above 400,000 cubic feet per second resuspend these sediments and transport constituent loads to the Bay well in excess of loads transported by the Susquehanna River at Harrisburg. (USGS)
W83-01847

PRODUCTION AND DECOMPOSITION OF FOREST LITTER FALL ON THE APALACHICOLA RIVER FLOOD PLAIN, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. F. Elder, and D. J. Cairns.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO 80225, Price: $10.25 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 82-252, 1982. 73 p, 23 Fig, 10 Tab, 50 Ref.

Descriptors: *Decomposition, *Trees, *Leaves, *Organic matter, Flood plains, Wetbanks, Forest, Litter, Vegetation, Productivity, Cycling nutrients, Detritus, *Florida, Apalachicola River.

Measurements of litter fall (leaves and other particulate organic material) and leaf decomposition were made on the Apalachicola River flood plain in 1979-80. Litter fall was collected monthly in five different forest types in swamp and levee areas. Leaves from 42 species of trees and other plants accounted for 58 percent of total litter fall. The remaining 42 percent was nonleaf material. Average litter fall was 800 grams per square meter per year in the flood plain. Tupelo (Nyssa), baldcypress (Taxodium), and ash (Fraxinus), all swamp-adapted trees, produce over 50 percent of the leaf fall. Common levee species such as sweetgum (Liquidambar styraciflua) and diamond-leaf oak (Quercus laurifolia) are also major contributors to total flood-plain litter fall. Annual flooding of the river provides an important mechanism for mobilization of the litter-fall products. Leaf decomposition rates were greatly reduced in dry environments. Carbon loss was nearly linear over a 6-month period, but nitrogen and phosphorus loss was exponential and nearly complete within 1 month. (USGS)
W83-01849

EVALUATION OF INCREASES IN DISSOLVED SOLIDS IN GROUND WATER, STOVEPIPE WELLS HOTEL, DEATH VALLEY NATIONAL MONUMENT, CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 5A.
W83-01858

DISTRIBUTION OF TOXIC SUBSTANCES IN RIVERS,
Princeton Univ., NJ. Dept. of Civil Engineering.
P. R. Jaffe, F. L. Parker, and D. J. Wilson.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No EE4, p 639-649, August, 1982. 5 Fig, 7 Tab, 7 Ref.

Descriptors: *Sampling, *Pesticides, *Vertical distribution, *Pollutant identification, Statistical analysis, Organic compounds, Chlorinated hydrocarbons, Kinetics, Probability distribution, Fate of pollutants, Nested analysis, Adsorption, Suspended sediments, Aldrin, Endrin, Chlordane, Hexachlorobenzene, Rivers, Heptachlor, Dieldrin, Solubility, *Tennessee, Wolf River, Memphis.

A statistical sampling design was used to determine the vertical distribution of hydrophobic organic pollutants in a river. Samples were collected in the Wolf River, Memphis, Tennessee, downstream of a dump used for disposal of pesticides manufacturing wastes before its closing 20 years ago. Since these substances were expected to have a nonhomogeneous vertical distribution due to density differences or adsorption on suspended sediments, samples were taken at different depths (10 each on the surface, mid-depth, and bottom at each location) to analyze the variance on a nested design. The vertical distribution of aldrin and suspended sediment was not uniform, but all other chlorinated compounds studied (hexachlorobenzene, heptachlor, dieldrin, chlordane, and endrin) had uniform vertical distributions. A study of grab sample probability distributions showed that log-normal distribution gave better descriptions of the grab sample distribution than normal distribution. Endrin showed the largest departure from normal distribution. Mean concentrations of the pesticides in bottom sediments were as high as 585 ng per g except for aldrin, which had unrealistically high levels, believed to be an interference during analysis. Pesticides were found adsorbed on suspended sediments, adsorbed on fine sediments, and in solution. No attenuation of the pesticides with distance was seen (possibly due to additional sources or resuspension). However, these compounds could have decay coefficients as high as 0.34 per km without being detected. Partition coefficients ranged from zero to 6 ng per g per liter, not including aldrin. (Cassar-FRC)
W83-01902

DISSIPATION OF 2,4-D RESIDUES IN LARGE RESERVOIRS,
Corps of Engineers, Washington, DC.
E. O. Gangstad.
Journal of Aquatic Plant Management, Vol 20, p 13-16, January, 1982. 3 Tab, 12 Ref.

Descriptors: *Aquatic weed control, *Herbicides, *Pesticide residues, Fate of pollutants, Reservoirs, Water pollution, Weed control, Aquatic plants, Factor analysis, Regression analysis, Mathematical studies, Temperature effects, *2,4-D.

The herbicide 2,4-dichlorophenoxyacetic acid (2,4-D) is the most effective and economical method of controlling Eurasian watermilfoil (Myriophyllum spicatum L.), which has become a very troublesome aquatic weed, presenting a serious and real threat to water resources. The characteristics of representative reservoirs which influence the levels, movement, and persistence of 2,4-D residues following application for control of aquatic weeds were investigated in an attempt to predict where application of this herbicide would be unsafe. Three factors were selected to describe reservoirs treated with 2,4-D: the volume of the water system, selected as an index of potential dilution effects; mean depth, chosen as a crude index of susceptibility to rooted aquatic weed infestation and, as a result, of the potential extent of herbicide application; and mean length of the growing season, selected as an index to temperature effects on herbicide residue degradation. The 2,4-D herbicides were applied to four reservoirs with conventional equipment at rates of 20 to 100 pounds acid equivalent per acre. The 2,4-D residue data for the reservoirs were subjected to stepwise multiple regression analysis. This analysis showed that the multiple correlation was highest with growing season. Correlations between residues and volume and rate were also significant, but to a lesser extent. The depth of the reservoir and the time after application were not significant factors in determining residue levels. The chemical residues in the reservoirs were similar for similar applications, and the standard rate of application (between 20 and 40 pounds acid equivalent per acre) did not produce residues above the tolerance level of 100 parts per billion. (Carroll-FRC)
W83-01932

VOLATILIZATION OF ORGANIC COMPOUNDS FROM STREAMS,
Geological Survey, NSTL Station, MS.
R. E. Rathbun, and D. Y. Tai.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No EE5, p 973-989, October, 1982. 3 Fig, 5 Tab, 36 Ref.

Descriptors: *Organic compounds, *Volatilization, Streams, *Ethylene, *Propane, Predicting, Estimating, Mathematical equations, Biochemical oxygen demand, Chemical reactions, Water quality control.

Mass-transfer coefficients for the volatilization of ethylene and propane are correlated with the hydraulic and geometric properties of seven streams, and predictive equations are developed. The equations are evaluated using a normalized root-mean-square error as the criterion of comparison. The two best equations are a two-variable equation containing the energy dissipated per unit mass per unit time and the average depth of flow and a three-variable equation containing the average velocity, the average depth of flow, and the slope of the stream. Procedures for adjusting the ethylene and propane coefficients for other organic compounds are evaluated. These procedures are bases on molecular diffusivity, molecular diameter, or molecular weight. Because of limited data, none of these procedures is extensively verified. Therefore, until additional data become available, it is suggested that the mass transfer coefficient be assumed to be inversely proportional to the square root of the molecular weight. (Baker-FRC)
W83-01943

TEMPERATURE/SEDIMENT MODEL FOR A SHALLOW LAKE,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
H. G. Stefan, S. Dhamotharan, and F. R. Schiebe.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No EE4, p 750-765, October, 1982. 10 Fig, 27 Ref.

Descriptors: *Suspended sediment, *Reservoirs, *Stratification, Water temperature, Temperature, Turbidity, Model studies, Shallow water, Lake Chicot, *Arkansas, Oxbow lakes, Water quality control, Fate of pollutants, Mixing, Albedo, Dissolved solids.

A model (RESQUAL) formulated for the effects of turbid water inflow into Lake Chicot, Arkansas, a shallow oxbow lake, is described. The model was designed to assist in rehabilitation of the lake, which lost its recreational attraction because of a flood in 1927, levee construction, and increases in row cropping in the watershed. The dynamic, unsteady, one-dimensional numerical model predicts water temperature, suspended sediment concentration, and dissolved solids. It considers energy exchange at the air-water interface as the forcing mechanism for stratification and mixing as well as inflow, outflow, and suspended and dissolved material loading from the inflow. The four major submodels predict: (1) surface heat transfer and temperature stratification, (2) suspended sediment diffusion and settling, (3) inflow and outflow in the presence of density stratification, and (4) dissolved material transport. Turbidity in the reservoir increases surface albedo and diffuse radiation attenuation. These affect water temperature and the strength of temperature stratification. The density stratification structure is dominated by water temperature. Suspended and dissolved solids increase water density by very small amounts. Inflowing water, sometimes containing 1000 ppm suspended sediment, can spread on the lake surface. Sinking turbidity currents form, not at highest turbidity, but at lowest inflow water temperature. Predic-

tions of water temperature and suspended sediment concentrations in the lake for a one year period agreed well with observed data. The model may also be used in design of detention basins and sediment trapping basins. (Cassar-FRC)
W83-01945

PREDICTION OF SULFIDE BUILDUP IN SANITARY SEWERS,
Lewis (Buck) Engineering, Inc., Tucson, AZ.
K. E. Kienow, R. D. Pomeroy, and K. K. Kienow.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No EE5, p 923-940, October, 1982. 14 Fig, 1 Tab, 18 Ref.

Descriptors: *Sulfides, *Sewer systems, Equations, Mathematical studies, Los Angeles, *California, Sewers, Gravity studies, Pomeroy-Parkhurst equations, Mathematical equations, Hydrogen sulfide, Gas, *Predicting, Model studies, Sulfur, Sulfates.

A graphical solution is developed for determining sulfide buildup in gravity sanitary sewer pipe. The method utilizes the Pomeroy-Parkhurst equations for sulfide buildup first published in 1977. The Pomeroy-Parkhurst equations are based on studies conducted over the past 20 years in the Los Angeles Sanitation District's system. An extensive bibliography of sulfide generation, effects, and case histories is included. (Baker-FRC)
W83-01946

NITRIFICATION, DENITRIFICATION, AND SORPTION-DESORPTION OF NH SUB 4-N IN SANDS DURING WATER MOVEMENT TO SUBSURFACE DRAINS,
Florida Univ., Gainesville. Dept. of Soil Science.
R. S. Mansell, J. G. A. Fiskell, and D. V. Calvert.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-167585, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Research Center Publication No 64, University of Florida, Gainesville, 1982. 80 p, 26 Fig, 17 Tab, 13 Ref, 1 Append. OWRT A-042-FLA(1), 14-34-0001-0110, 14-34-0001-1110.

Descriptors: *Nitrogen, Isotopes, Leaching, Drainage, Tillage, *Fate of pollutants, *Soil water movement, *Nitrification, Sands, *Denitrification, Drains, Sorption, Florida, Citrus crops, *Fertilizers, *Nitrate-nitrogen, *Spodosol, Absorption, Lime.

Isotopically labelled (super 15N-depleted (NH sub 4) sub 2 SO sub 4) N fertilizer was applied at a rate of 115 kg N/ha to a Florida citrus grove located in a subsurface drained Spodosol in order to determine the fate of applied N. The fertilizer was applied to one 0.22-ha field plot each of shallow-tilled (ST), deep-tilled (DT), and deep-limed/tilled (DTL) soil. Analyses of soil, soil solution, drainage water, and citrus leaf samples revealed that much of the NH sub 4-N was nitrified to form NO sub 3-N during the first 42 days after application of fertilizer. Partially because of a local drought, most of the applied N was absorbed by plant roots during the first 134 days and leaching losses in drainage water were less than 4% of the amount applied. Rates of nitrification and N uptake by roots were highest for DTL and lowest for ST treatments. Selective deep tillage with lime incorporation of Spodosols appears to be an effective means to manage fertilizer and water resources for citrus and possibly other agricultural crops without contaminating groundwater supplies.
W83-01955

CHEMICAL PROPERTIES AND MINERALOGICAL CHARACTERISTICS OF SELECTED DREDGED MATERIAL,
Wisconsin Univ.-Madison. Dept. of Soil Science.
S. M. Combs, R. H. Dowdy, S. C. Gupta, W. E. Larson, and R. G. Gast.
Journal of Environmental Quality, Vol II, No 2, p 255-261, April-June, 1982. 2 Fig, 41 Ref.

Descriptors: *Spoil banks, *Chemical properties, *Minerology, *Metals, Heavy metals, Cation exchange, Acidity, Alkalinity, Dredging, Nutrients, Oxides.

Large quantities of sediment must be dredged from U.S. waterways each year. One potential alternative to current methods for the disposal of this dredged material is the use of the dredged spoils for reconditioning of lands marginally suited for agricultural production. The chemical properties, metal contents, and mineralogical characteristics of dredged material from ten fresh-water and estuarine waterways in the eastern and central United States were evaluated as a part of a study of the feasibility of this alternative. Dredged materials ranged from very acidic to alkaline in reaction, with acidity attributed to the oxidation of sulphur and iron ions in the spoils. The cation exchange capacity values of the dredged materials ranged from 1.0 to 33.5 meq per 100 grams, with organic matter contents accounting for about 60% of this variation in fine-textured spoils. Total nitrogen was mainly in organic forms, and the carbon to nitrogen ratios ranged from 13 to 1 to 22 to 1. Variable accumulations of nutrients and metals in the dredged materials reflected contamination levels in the waterways. The levels of aluminum, calcium, potassium, magnesium, phosphorus, and sulfur were generally higher in the dredged material than in reference Minnesota soils, while the levels of cadmium, chromium, nickel, lead, zinc, and copper were substantially higher in the spoils. Manganese concentrations were substantially less in the dredged material than in the soils. Mineralogy varied with geographic location, contributing watershed, and environmental conditions. Kaolinite and illite were present in all dredged material, while the amounts of montmorillonite varied due to some conversion to pedogenic chlorite during sediment drainage. There were indications of precipitation of colloidal-sized hydrous oxide particles and/or surface coatings on clay complexes. (Carroll-FRC)
W83-01970

MONITORING OF A MUNICIPAL SLUDGE ENTRENCHMENT SITE,
Agricultural Research Service, Beltsville, MD. Biological Waste Management and Organic Resources Lab.
L. J. Sikora, W. D. Burge, and J. E. Jones.
Journal of Environmental Quality, Vol 11, No 2, p 321-326, April-June, 1982. 7 Fig, 2 Tab, 18 Ref.

Descriptors: *Trenches, *Land disposal, *Sludge disposal, Nitrogen, Heavy metals, Municipal wastewater, Coliforms, Bacteria, Leachates, Nitrogen compounds, Nitrogen removal, Fate of pollutants, Groundwater contamination, On-site studies.

Entrenchment of sewage sludge has raised concerns about groundwater quality due to the high application rates. Raw, highly-limed filter-cake sludge (22% solids) was entrenched in 18 hectares of well-drained silt loam soil at a rate of 2,200 wet metric tons per hectare. Sampling was conducted at 20, 37, and 45 months after entrenchment in order to determine the mineralization and movement of nitrogen and movement of heavy metals, as well as the die-off rates and movement of salmonellae, ascaris ova, and fecal indicators in the entrenched sludge and soil profile. Total nitrogen, ammonium-nitrogen (NH4-N), and chloride levels decreased in the entrenched sludge with time and leached through the soil profile past the lowest sampling point, which was 100 centimeters below the trench bottom. Nitrate-nitrogen also migrated to this lowest sampling point. There was no direct evidence of denitrification. There were only negligible heavy metal losses from the entrenched sludge, probably due to the fact that the pH of the sludge was above 7.0 through the period investigated. A predictive equation based on decreases in sludge total nitrogen was developed for use as a tool for determining the age at which the entrenched sludge was stabilized. Pathogen hazards associated with the entrenched, limed sludge appeared to be minimal, with very low concentrations of fecal coliforms and no detectable ascaris ova. Possible contamination of groundwater by nitrogen leached from the sludge was found to be the major environmental effect of sludge entrenchment. (Carroll-FRC)
W83-01972

ENVIRONMENTAL EFFECTS OF A MEDIUM-FERTILITY 12-MONTH PASTURE PROGRAM: II. NITROGEN,
Agricultural Research Service, Coshocton, OH. North Appalachian Experimental Watershed.
For primary bibliographic entry see Field 5G.
W83-01974

PREDICTION OF PHOSPHORUS LOSSES IN RUNOFF FROM SOUTHERN PLAINS WATERSHEDS,
Oklahoma State Univ., Stillwater. Dept. of Agronomy.
A. N. Sharpley, S. J. Smith, and R. G. Menzel.
Journal of Environmental Quality, Vol 11, No 2, p 247-251, April-June, 1982. 2 Fig, 5 Tab, 23 Ref.

Descriptors: *Phosphorus, *Rainfall-runoff relationships, Runoff, *Prediction, Mathematical models, Soil erosion, Watersheds, Grasslands, Cropland, Sediment discharge, Performance evaluation, *Simulation analysis, *Southern Plains, Model studies, *CREAMS model, *Path of pollutants.

Relationships developed from simulated rainfall-runoff experiments on soils collected from several cropland and grassland watersheds in the Southern Plains and used to predict the losses of soluble and particulate phosphorus in runoff from these watersheds were evaluated. Soluble phosphorus was predicted from the water-extractable phosphorus content of surface soil (to a depth of 1 centimeter) collected in March of each year, using a general phosphorus-extraction coefficient covering all of the soils found in the subject watersheds. For individual soils, the phosphorus-extraction coefficient was related to the depth of interaction between surface soil and runoff. The level of phosphorus attached to eroded soil transported in runoff was predicted from the total phosphorus content of surface soil collected in March of each year using phosphorus-enrichment ratios calculated from sediment discharge. The predictions of mean annual soluble and particulate phosphorus concentrations with different fertilizer and watershed management practices, soil types, and vegetative covers. The results indicate that the relationships used in the CREAMS (Chemicals, Runoff, and Erosion from Agricultural Management Systems) model can provide accurate predictions of mean annual soluble and total phosphorus concentrations in runoff. (Carroll-FRC)
W83-01979

MOVEMENT OF HEAVY METALS IN SEWAGE SLUDGE-TREATED SOILS,
Agricultural Research Service, Tucson, AZ.
W. E. Emmerich, L. J. Lund, A. L. Page, and A. C. Chang.
Journal of Environmental Quality, Vol 11, No 2, p 174-178, April-June, 1982. 1 Fig, 5 Tab, 15 Ref.

Descriptors: *Heavy metals, *Soil columns, *Sludge disposal, Cadmium, Copper, Nickel, Zinc, Land disposal, Digested sludge, Groundwater pollution, Soil columns, *Path of pollutants, *Sewage sludge.

Sewage sludges contain varying amounts of heavy metals, which raises concerns regarding the land application of these sludges. Although considerable research has addressed the application of these sludges to crop land and the subsequent plant uptake of heavy metals, little attention has been given to the possible contamination of groundwater by heavy metals from land application of sewage sludge. The potential for cadmium, copper, nickel, and zinc movement through soil profiles following application of sewage sludge to the surface was investigated using a controlled study with three reconstructed soil columns. Liquid or air-dried anaerobically digested sewage sludge was mixed into the top 15 centimeters of the soil three times for a total rate of 476 metric tons per hectare. The soil columns were leached with 5 meters of Colorado River water over a 25-month period. A complete metal mass balance analysis showed that essentially no metals moved below the depth of incorporation of sludge. Close to 100% of the added metals were recovered in the sludge-soil

layers, and virtually none were recovered below this level of incorporation. The soil profiles beneath the sludge-soil layers exhibited greatly lowered pH, probably due to the mineralization and nitrification of the added organic nitrogen. As a result, a subsequent pH reduction in the sludge-soil layer could increase the solubilization of the metals and induce movement in the soil profiles, even though this was not observed within the time frame of this study. (Carroll-FRC)
W83-01980

ADSORPTION OF REOVIRUS BY MINERALS AND SOILS,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
R. S. Moore, D. H. Taylor, M. M. M. Reddy, and L. S. Sturman.
Applied and Environmental Microbiology, Vol 44, No 4, p 852-859, October, 1982. 2 Fig, 4 Tab, 28 Ref.

Descriptors: *Viruses, *Land disposal, *Adsorption, *Fate of pollutants, *Soil types, *Minerals, Wastewater disposal, Adsorbents, Cations, Organic matter, Sludge, Pathogens, Separation techniques, Reovirus.

The adsorption of S35-methionine-labeled reovirus by 30 dry soils, minerals, and finely ground rocks suspended in synthetic freshwater at pH7 was studied to determine the conditions needed for optimum virus removal during land application of wastewaters. All of the minerals and soils studied adsorbed over 99% of the virus at 4 degrees after 1 hr. The remaining suspended viruses were significantly inactivated with a three to five log reduction in titer. The presence of divalent cations in the synthetic freshwater increased virus adsorption, while soluble organic matter decreased viral adsorption in secondary effluent. Adsorption increased with increasing available surface area. The inverse correlation between virus adsorption and substrate capacity for cationic polyelectrolyte suggests that the adsorption of infectious reovirus particles is mostly a charged colloidal particle-charged surface interaction, so that the adsorption of polyelectrolyte may be a useful parameter in predicting the fate of viruses during land application of wastewaters and sludges. (Geiger-FRC)
W83-01995

RESIDUES OF O,P'-DDT IN SOUTHERN CALIFORNIA COASTAL SEDIMENTS IN 1971,
California Univ., Davis. Dept. of Wildlife and Fisheries Biology.
D. W. Anderson, W. T. Castle, L. A. Woods, Jr., and L. A. Ayres.
Bulletin of Environmental Contamination and Toxicology, Vol 29, No 4, p 429-433, 1982. 1 Fig, 1 Tab, 12 Ref.

Descriptors: *DDT, *Insecticides, *Sediments, Fate of pollutants, Chlorinated hydrocarbons, *Pesticide residues, *California, Los Angeles, Marine sediments.

Total DDT and four metabolities were determined in intertidal sediments near river outlets off the southern California coast during 1971. Sampling locations were grouped into 2 areas: (1) Los Angeles-Point Conception and (2) the outlier regions north (Monterey) and south of Los Angeles. Total DDT concentrations were: Los Angeles, 0.131 + or - 0.050 ppm; outliers, + or - 0.034 ppm. A significant finding was that o,p'-DDT was present at 0.005 + or - 0.003 ppm in the Los Angeles sediments at a time when biological problems with wildlife were evident. (Cassar-FRC)
W83-02025

PERSISTANCE OF FORMULATED FENITROTHION IN DISTILLED, ESTUARINE, AND LAKE WATER MICROCOSMS IN DYNAMIC AND STATIC SYSTEMS,
Ottawa Univ. (Ontario). Dept. of Biology.
P. Weinberger, R. Greenhalgh, D. Sher, and M. Quellette.
Bulletin of Environmental Contamination and Toxicology, Vol 28, No 4, p 484-489, 1982. 6 Fig, 17 Ref.

Descriptors: *Pesticides, Chemical degradation, Hydrogen ion concentration, Lakes, *Canada, Estuaries, Streams, Path of pollutants, Fate of pollutants, *Fenitrothion.

Fenitrothion represents a significant percentage of all pesticidal chemicals used in Canada. Tests with natural lake and estuarine water were conducted to investigate the degradation and partitioning of fenitrothion in a dynamic system simulating a stream flowing into a lake or an estuary, into a bay, and in static systems. The fenitrothion was formulated with atlox and mixed with either Aerotex or Dowanol. The chemical reactions in the dynamic system and in the static systems were examined at pH values of 4.5, 6.8, and 8.5. No fenitrothion degradation products were found at any of the three sampling points in the dynamic system, and mass balance analyses indicated that there was no breakdown of the fenitrothion. Dilution and elution were the only factors controlling the concentration of fenitrothion in the dynamic model system, with the pesticide accumulating in the lake or bay downstream from application. Photolysis and hydrolysis of fenitrothion were unaffected by pH or type of water in the static lake and bay models. Degradation in estuarine water was greater than in the other waters, probably due to the ions and/or microflora in the estuarine waters. The study results indicate that the sites downstream of spray areas are highly vulnerable to pesticide perturbations and that laboratory studies using distilled water in the evaluation of chemical degradation of pesticides may be only marginally relevant to processes occurring in natural waters. (Carroll-FRC)
W83-02026

MEASUREMENT OF LOW LEVELS OF MOLYBDENUM IN THE ENVIRONMENT BY USING AQUATIC INSECTS,
Western State Coll. of Colorado, Gunnison.
For primary bibliographic entry see Field 5A.
W83-02027

REAL TIME SIMULATION OF CONDUCTIVITY IN RIVER-LAKE SYSTEMS,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Environmental Science.
C. G. Uchrin, and W. J. Weber, Jr.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers. Vol 108, No EE5, p 1027-1044, October, 1982. 23 Fig, 4 Tab, 17 Ref.

Descriptors: *Model studies, *Pollutant transport, *Fate of pollutants, Water quality, Water pollution control, *Conductivity, Lakes, Dispersion, *Michigan, Ford Lake, Bellesville Lake, Path of pollutants.

Conductivity is modeled in real time in a natural water system using the finite section method. Dispersion coefficients are estimated using methods available in the literature. Calibration is performed together with sensitivity analyses. Small scale effects are defined by a dye study. The resultant model is eventually used in the construction of system models describing the transport and fate of various pollutants in the Ford Lake-Belleville Lake System, Michigan. The methodology presented represents a simpler and less costly procedure for quantifying water mass transport in a advective-dispersive system than the more deterministic methods which involve coupling of momentum conservation and continuity equations to the mass balance equation. For simple systems, such as the one examined in this paper, the use of a simpler modeling approach seems justified. (Baker-FRC)
W83-02034

FIELD-TO-STREAM TRANSPORT OF AGRICULTURAL CHEMICALS AND SEDIMENT IN AN IOWA WATERSHED: PART I. DATA BASE FOR MODEL TESTING (1976-1978),
Iowa State Univ., Ames.
H. P. Johnson, and J. L. Baker.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-254046, Price codes: A25 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S3-82-032, September 1982. 4 p, 1 Fig, 3 Tab.

Descriptors: *Agricultural runoff, *Sediments, *Soil erosion, *Pesticides, *Surface runoff, Iowa, Herbicides, Nitrogen compounds, Agricultural chemicals, Agricultural watersheds, Storm seepage, Nonpoint sources, Precipitation, Streamflow.

In order to provide information for testing and evaluating mathematical models under development for predicting agricultural nonpoint source pollution, data were collected for small corn, soybean, and pasture fields; for two larger mixed-cover watersheds; and at three drainage-stream sites. The study area was located in the upper portion of the Four Mile Creek watershed in Tama County, Iowa. Precipitation during the study averaged 92% of normal. Average annual stream-flow from the whole watershed was 124 mm. Sediment losses were also low because of a lack of intense rains, averaging 2.6 t/ha from row-crops and 0.9 t/ha from the watershed as a whole. Average surface runoff losses from pasture, corn, and soybean fields of all dissolved chemicals were less than the amount deposited by precipitation. Because nitrite-nitrogen, chlorine and total dissolved solids were concentrated in subsurface drainage, losses from the watershed as a whole due to streamflow (surface plus subsurface drainage) were significantly larger than losses from surface runoff alone. Average annual pesticide losses from the field were least for the shortest-lived herbicide and greatest for the most persistent. Losses of the herbicides with streamflow from the whole watershed, on a percentage of applied basis, were about 25% of the edge of field losses With the exception of the strongly adsorbed paraquat, at least 80% of the losses occurred in the water phase as opposed to that adsorbed on sediment. (Moore-SRC)
W83-02041

RIVER BASIN VALIDATION OF THE WATER QUALITY ASSESSMENT METHODOLOGY FOR SCREENING NONDESIGNATED 208 AREAS: VOLUMES I AND II,
Midwest Research Inst., Kansas City, MO.
M. J. Davis, M. K. Snyder, and J. W. Nebgen.
Environmental Protection Agency Project Summary EPA-600/S3-82-057, September 1982. 6 p, 3 Tab.

Descriptors: *Water quality, *Nutrients, *Model studies, *Soil erosion, *River basins, Estuaries, Watershed management, Simulation, Mathematical models, Pollution load.

Techniques for estimating diffuse nutrient loads and their water quality effects throughout large watersheds were tested under various field situations for a wide range of data availability circumstances, water quality parameters, and hydrologic-hydraulic conditions, in five river basins, including the Sandusky River in Ohio, the Chester and Patuxent Rivers in Maryland, and the Ware and Occoquan Rivers in Virginia. Obtaining sufficient data to operate the model was the biggest problem in applying the loading methodology to specific river basins. Given the inherent inaccuracy in the basic Universal Soil Loss Equation (USLE) approach, use of the national data base was justified, especially if supplemented with specific county cover (R) factors. Despite the inaccuracies resulting from the use of a national data base, two to three person weeks of effort per basin should produce useful inputs to water quality screening assessments. The loading methods and the water quality methods tested in this study were highly compatible and gave reasonably accurate predictions of instream, lake, and estuary water quality constituent concentrations. The river modeling methods are the most accurate, followed by the techniques for estuaries and then impoundments. Low flow, steady state conditions are better predicted than high flow, unsteady loading situations. Applying these techniques, the watershed management planner should be able to recommend appropriate actions to investigate pollutant problem areas more closely in specific watersheds. (Moore-SRC)
W83-02042

COMPARATIVE ANALYSIS AND DEVELOPMENT OF MODELS FOR GROUNDWATER QUALITY PREDICTION,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
S. P. Neuman, and E. S. Simpson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-167791, Price codes: A02 in paper copy, A01 in microfiche. Completion Report, 1982. 16 p, 74 Ref. OWRT B-074-ARIZ(1), 14-34-0001-9057.

Descriptors: *Mathematical models, *Groundwater pollution, *Advection, *Dispersion, *Groundwater movement, Radioactive wastes, Mathematical equations, Prediction.

The advection-dispersion equation is widely used to describe Fickian transport of pollutants, and in recent years there has been much interest in the possibility of using this equation to predict the effect of groundwater flow on the migration of radio nuclides from geological repositories of nuclear waste to the biosphere. A comparative analysis of numerical approaches to advection-dispersion suggests that these can be broadly classified as Eulerian, Lagrangian, and Eulerian-Lagrangian. In Eulerian methods, the time step size is limited by the Courant-Friedrichs-Lewy condition. Lagrangian methods are based either on a deforming grid, or a fixed grid in deforming coordinates. They usually allow larger time steps than Eulerian methods, and exhibit a lesser degree of oscellation and numerical dispersion. Unfortunately, they are not always well suited for complex problems where multiple concentration fronts propagate through nonuniform two or three dimensional media. For such problems, Eulerian-Lagrangian methods show the greatest promise, as they are able to combine the simplicity of a fixed Eulerian grid with the computational power of the Lagrangian approach. A rigorous theoretical foundation was developed for the Eulerian-Lagrangian method. (Moore-SRC)
W83-02049

SOURCES OF PCBS TO WISCONSIN LAKES,
Wisconsin Univ.-Madison. Dept. of Water Chemistry.
For primary bibliographic entry see Field 5A.
W83-02059

A NOVEL INTEGRATIVE TECHNIQUE FOR LOCATING AND MONITORING POLYNUCLEAR AROMATIC HYDROCARBON DISCHARGES TO THE AQUATIC ENVIRONMENT,
Roswell Park Memorial Inst., Buffalo, NY.
For primary bibliographic entry see Field 5A.
W83-02093

5C. Effects Of Pollution

THE DETERMINATION OF RESIDUAL AMOUNTS OF ORGANOCHLORINE PESTICIDES IN THE RYBINSK RESERVOIR FISH,
Columbia National Fisheries Research Lab., MO.
F. L. Mayer, J. D. Petty, V. I. Kozlovskaya, and B. A. Flerov.
Hydrobiological Journal, Vol 17, No 5, p 63-70, 1981, 5 Tab, 6 Ref.

Descriptors: *Roach, Water pollution effects, *Pike, *Pesticide residues, *Pesticide toxicity, *Halogenated pesticides, Toxicity, Fish, Reservoirs, Farm wastes, Fish physiology, DDT, DDD, Rivers, *USSR, Rybinsk Reservoir, Chesnava River, Udyna River, Gas chromatography, *Pollutant identification.

Pesticides used on croplands adjacent to the Rybinsk Reservoir may enter the reservoir in runoff water and pose a hazard to aquatic organisms. A study was made to determine persistent pesticide residues in fish caught in suspected pollution zones at the mouths of the Chesnava and Udyna Rivers in the Rybinsk River and determine biochemical changes in fish vertebrae which may reflect the physiological condition of the fish. Organochlorine pesticide residues were determined in samples of roach and pike by gas chromatography. Collagen, calcium, and phosphorus were determined in the backbone of each fish, and hydroxyproline was determined on each isolated collagen fraction. Three-year-old roach from the Udyna area contained 1-2 micrograms/gram of pesticide residues, while the Udyna pike contained much less. Both pike and roach from the control area near Borok contained only traces of pesticide residues. The large amounts of pesticides found in roach were attributed to the higher lipid content of the fish plus its manner and frequency of feeding. Fish from the Chesnava river appeared to contain the greatest amounts of chlorinated pesticides. The older fish from all samples contained more pesticide residues than the younger fish. Results of backbone studies revealed no real adverse differences, suggesting that the present use of pesticides on lands near the reservoir is of minor concern. High levels of suspended organic matter in the reservoir may be mediating any possible pesticide effect. (Geiger-FRC)
W83-01754

MERCURY AND OTHER HEAVY METALS IN THE WATER: MIGRATION, ACCUMULATION, AND TOXICITY TO AQUATIC ORGANISMS (A REVIEW),
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
For primary bibliographic entry see Field 5B.
W83-01755

DETERMINATION OF EFFLUENT TOXICITY FROM STATE OF PIGMENTED CELLS AND NEURAL APPARATUS OF FISH SKIN,
Volgograd State Medical Inst. (USSR).
For primary bibliographic entry see Field 5A.
W83-01765

THE EFFECTS OF EFFLUENTS OF THE KURSK THERMAL POWER STATION ON ZOOPLANKTON,
All-Union Research Inst. of Pond Fisheries, Rybnoe (USSR).
V. A. Kostylev, and M. A. Yesipova.
Hydrobiological Journal, Vol 17, No 5, p 26-28, 1981. 1 Fig.

Descriptors: *Zooplankton, *Thermal stress, *Thermal pollution, *Thermal powerplants, Temperature effects, Water pollution effects, Plankton, Powerplants, Ecological effects, Thermal water, Fish, *USSR, Kursk thermal power station.

In 1975, 1976, and 1977, a total of 108 zooplankton samples were collected from April to November from fixed points in the warm and cold channels of the Kursk thermal power station to study the effects of the powerplant on the zooplankton and the fish-breeding plant downstream. Zooplankton samples were collected using a Patalas sampling bottle and a plankton net with a No. 76 miller's gauze. Zooplankton biomass was estimated from tables of F. D. Morduhay-Boltovskiy (1954) and S. N. Ulomskiy (1951). Results showed that mechanical damage of zooplankters upon passage through the powerplants, while significant, was probably less of a factor in their mortality than the large thermal gradient between the input and outlet water. The zooplankton from the warm channel provides the 'seed' for the development of zooplankton in the latter ponds. In the zooplankton of the cold channel, Daphnia and rotifers of the genera Asplanchna, Tilinia and Keratella dominated, while in the warm channel, Daphnia and Cyclops (Daphnia longispina, D. magna, and Cyclops sp.) dominated. Toxic agents added to the water also contributed to zooplankton mortality. (Geiger-FRC)
W83-01766

LONG-TERM EFFECTS OF HEAVY METALS ON AQUATIC PLANTS,
Vrije Univ., Amsterdam (Netherlands). Biological Lab.
M. van der Werff, and M. J. Pruyt.
Chemosphere, Vol 11, No 8, p 727-739, August 1982. 4 Fig, 2 Tab, 46 Ref.

Descriptors: *Uptake, *Aquatic plants, *Heavy metals, *Bioindicators, *Growth, Copper, Zinc, Cadmium, Lead, Submerged plants, Rooted aquatic plants, Metals.

The uptake of low levels of zinc, copper, lead and cadmium by four aquatic plants and the effects of these heavy metals on growth was examined in Elodea nuttallii, Callitriche platycarpa, Spirodela polyrhiza and Lemma gibba. No differentiation in growth or mortality was detected depending on species or elements, except in Elodea, which was sensitive to 5 micromoles of copper. Clear differences were observed between the uptake levels of the heavy metals among species, with greater uptake in the desubmerged plants than in the floating ones. For zinc, lead, and cadmium, an equal ratio was detected between the concentration of the metal in the medium and in the plant tissue independent of the plant species. The roles of roots in metal absorption and the feasibility of using aquatic plants as bioindicators of heavy metal pollution in Dutch waters are discussed. (Geiger-FRC)
W83-01768

THE SPATIAL DISTRIBUTION OF THE FRESHWATER MACROINVERTEBRATE FAUNA OF THE RIVER ELY, SOUTH WALES, IN RELATION TO POLLUTIONAL DISCHARGES,
University of Wales Inst. of Science and Technology, Cardiff. Dept. of Applied Biology.
P. M. Murphy, and R. W. Edwards.
Environmental Pollution, Series A, Vol 29, No 2, p 111-124, October, 1982. 4 Fig, 1 Tab, 46 Ref.

Descriptors: *Macroinvertebrates, *Multivariate analysis, *Species composition, Water pollution effects, Cluster analsis, Nodal analysis, Spatial distribution, Rivers, Ely River, *Wales, Ammonia, Suspended solids, Coal, Coking plants, Wastewater pollution, Organic matter, Benthic fauna, Water quality.

Spatial distribution of macroinvertebrate fauna, sampled in March and July 1977 at 20 sites in the Ely River catchment, Wales, was analyzed by cluster and nodal analysis. This river receives poorly treated sewage at several locations and effluent from two coking plants (ammonia and suspended coal solids). Results of the multivariate analysis showed distinct assemblages inhabiting each of several habitats: unpolluted, organically enriched, recovery, and polluted with coking wastes. At the most severely polluted sites only tubificid species were present. Lowest abundance was associated with unpolluted and severely polluted sites; intermediate abundance with the recovery zone and at sites moderately contaminated with ammonia, suspended solids, and organic wastes; and highest abundance with sites impacted by sewage enrichment alone. Little change in species composition was seen directly downstream of the Royal Mint, which discharges heavy metals into the river. (Cassar-FRC)
W83-01775

CONCENTRATIONS OF HEAVY METALS IN THE TISSUES OF TROUT SALMO TRUTTA AND CHAR SALVELINUS ALPINUS FROM TWO LAKES IN NORTH WALES,
Liverpool Univ. (England). Dept. of Zoology.
I. G. Cowx.
Environmental Pollution, Series A, Vol 29, No 2, p 101-110, October, 1982. 2 Fig, 4 Tab, 26 Ref.

Descriptors: Fish, *Heavy metals, *Lakes, *Trout, *Char, Metals, *Wales, Llyn Peris, Llyn Padarn, *Oligotrophic lakes, Zinc, Iron, Copper, Manganese, *Fate of pollutants, Bioaccumulation, Accumulation, Mine wastes, *Spectrophotometry, Atomic absoprtion spectrophotometry, Pollutant identification.

Heavy metals (Zn, Fe, Mn, and Cu) were determined in scales, bones, liver, kidney, and muscle of brown trout (Salmo trutta L.) and char (Salvelinus alpinus L.) from Llyn Peris and Llyn Padarn, two oligotrophic lakes connected by a 200 m stretch of river in Wales. Metal-containing igneous deposits

and mining were associated with these lakes. Metals levels in the two waters were similar, a maximum of 58 ppm Zn, 60 ppm Fe, 10 ppm Mn, and 2.2 ppm Cu. In both types of fish and in both lakes Mn appeared to be concentrated in bone and scales; Cu in the liver, and Fe in liver and kidney. Zn was more variably distributed, with high levels in scales of both fish and kidney of trout. Trout liver and kidney had higher levels of Zn than char from the same lakes. Trout liver had higher levels of Cu than char liver. In Llyn Peris, char liver had 5 times higher Fe levels than trout liver. Peris char had 4 times higher Fe concentrations in liver than Padarn char. The differences in Fe concentrations in fish from the two lakes possibly related to the existence of distinct char populations. (Cassar-FRC)
W83-01780

MUTAGENIC ACTIVITY OF ORGANIC MATTER IN AN URBAN RIVER SEDIMENT,
Tokyo Univ. (Japan). Faculty of Pharmaceutical Sciences.
J. Suzuki, T. Sadamasu, and S. Suzuki.
Environmental Pollution, Series A; Vol 29, No 2, p 91-99, October, 1982. 5 Fig, 1 Tab, 15 Ref.

Descriptors: *Organic matter, *Sediments, *Mutagens, Rivers, Organic compounds, Carcinogens, Urban areas, Industrial wastes, Tama River, Tokyo, *Japan, Water pollution effects, Aromatic hydrocarbons, Sediments, Pollutant identification, *Chromatography.

Organic sediments from the Tama River, an industrial river running through Tokyo, Japan, were tested for mutagenic activity. Samples were collected at Wada, a relatively unpolluted upstream location, and at Daishi, a heavily polluted site near the river mouth in Tokyo Bay. Sediments were separated into 14 fractions by solvent extraction and silica gel chromatography. The mutagenicity of the fractions was assayed by the Ames test using strains TA98 and TA100 of Salmonella typhimurium. Total mutagenicity, expressed as micrograms of benzo(a)pyrene, was 32 in the upper river and 360 in the lower river. The basic and neutral water extracts were especially mutagenic. Thin-layer chromatography of the fractions indicated that mutagenicity was attributable primarily to polar compounds containing O and N rather than polycyclic aromatic hydrocarbons. (Cassar-FRC)
W83-01781

FIELD AND EXPERIMENTAL EVALUATION OF ENTEROMORPHA SP. AS A QUALI-QUANTITATIVE MONITORING ORGANISM FOR COPPER AND MERCURY IN ESTUARIES,
Fundacao Univ., Rio Grande (Brazil). Dept. of Oceanography.
U. Seeliger, and C. Cordazzo.
Environmental Pollution, Series A, Vol 29, No 3, p 197-206, November, 1982. 6 Fig, 33 Ref.

Descriptors: *Copper, *Mercury, *Uptake, *Chlorophyta, *Estuaries, *Regression analysis, *Bioindicators, *Fate of pollutants, Heavy metals, Metals, Algae, Bioaccumulation, Accumulation, Retention, Algal growth, *Brazil, Patos Lagoon estuary.

The feasibility of using the green alga, Enteromorpha sp., as a qualitative-quantitative monitor of dissolved inorganic copper (Cu) and mercury (Hg) concentrations in estuarine waters was studied in field and laboratory tests. In the laboratory studies, the uptake and retention of the metals by the algae was examined after exposure of cultures in Fernbach flasks for 6, 12 or 18 days. Field studies monitored the levels of Cu and Hg in algal and water samples taken from four sites in the Patos Lagoon estuary, Brazil. Regression analysis was used to determine correlation factors, and confidence intervals of the mean were calculated for all comparisons of data. Results showed that accumulation of both metals in Enteromorpha followed linear equations with high coefficients of correlation and was directly related to dissolved inorganic forms of Hg and Cu in the medium. The rate of uptake was higher for Cu than for Hg. Loss of Hg and Cu from algal tissues was not significant after 18 days of growth in metal-free medium. Rather, tissue levels of the metals decreased, probably due to increases in Enteromorpha biomass. Salinity changes had not significant effect on metal uptake by the alga, but metal incorporation was reduced by chelation with EDTA. Concentration factors for the metals in the alga derived from field data were used to calculate the expected mean annual dissolved Cu and Hg levels in the estuarine water column. (Geiger-FRC)
W83-01782

DEPENDENCE OF SORPTION RATES OF RADIONUCLIDES BY FRESHWATER PLANTS ON THE PH OF THE WATER,
Akademiya Nauk SSSR, Sverdlovsk.
For primary bibliographic entry see Field 5B.
W83-01786

HAIR MERCURY CONTENTS AND FISH EATING HABITS OF PEOPLE LIVING NEAR A FINNISH MAN-MADE LAKE,
Helsinki Univ. (Finland). Dept. of Environmental Science.
M. Lodenius, and A. Seppanen.
Chemosphere, Vol 11, No 8, p 755-759, August, 1982. 3 Fig, 1 Tab, 15 Ref.

Descriptors: *Fate of pollutants, *Water pollution sources, *Mercury, Fish, *Biological magnification, *Lakes, Heavy metals, Bioaccumulation, Adsorption, Uptake, Pulp wastes, *Finland.

High mercury (Hg) levels have been found in fish from the man-made lake, Lake Kalajarvi in western Finland. At the end of October of 1980, sale of fish from the lake was banned. In February of 1981, 35 hair samples were taken from people who had eaten the Hg-contaminated fish. The samples were divided into 1.5 centimeter long segments starting from the scalp before being analyzed for Hg by cold vapor atomic absorption spectrometry. The mean Hg content in hair of people who ate the contaminated fish was, at a maximum, 6.6 milligrams/kilogram, or about four times higher than that of people who ate fish from unpolluted lakes of northern Finland. Higher levels of Hg in hair samples have been noted in people who ate fish from waters polluted by phenylmercury from the pulp industry. (Geiger-FRC)
W83-01787

METALIMNETIC OXYGEN DEPLETION IN LAKE MEAD AS IT RELATES TO THE LIMNETIC ZOOPLANKTON COMMUNITY,
Nevada Univ., Las Vegas. Dept. of Biological Sciences.
T. A. Burke.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-154476, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Center Publication No 1, University of Nevada, Reno, February, 1980. 95 p, 14 Tab, 7 Fig, 88 Ref, 1 Append. OWRT A-066-NEV(2), 14-34-0001-6029.

Descriptors: *Zooplankton, Oxygen demand, Limnology, *Metalimnion, *Thermal stratification, Aquatic community oxygen transport, Ecologic considerations, Boulder Basin, *Lake Mead, *Nevada, *Oxygen depletion.

The limnetic zooplankton community of Boulder Basin, Lake Mead, was examined to determine the role of this community in the development of a metalimnetic oxygen minimum which regularly occurs in the lake. Analysis of the community from May 1975 to April 1976 revealed that zooplankton maintain high populations within the metalimnion during summer stratification. The species composition of the community changes noticeably during the summer, but due to advanced stages existing from resting forms, a complete assemblage of individuals are found throughout the 74 day period studied. Thermal stratification was weak, covering a 30 meter metalimnion. Eddy currents powered by wind action brought oxygen into this zone from the surface, and mixing at the metalimnion-hypolimnion due to internal waves and density flows brought oxygen up into this zone. The metalimnion was sactioned into two 15 meter layers. The zooplankton consumed 33 to 69% of the daily oxygen lost from the upper section and 12 to 42% from the lower section of the metalimnion from June 17 to August 28, 1975. The metalimneric oxygen depletion of Boulder Basin is due to the oxygen consumption of the complete aquatic community of producers, consumers, and reducers. The zooplankton, representing the major consumers, account for a significant portion of the oxygen depletion.
W83-01789

IRRIGATION WATER QUALITY OF SOME NATAL RIVERS,
Natal Univ., Pietermaritzburg (South Africa). Dept. of Soil Science and Agrometeorology.
A. Cass.
Water SA, Vol 8, No 3, p 155-164, July, 1982. 2 Fig, 2 Tab, 30 Ref.

Descriptors: *Saline water, *Irrigation water, *Soil solution, *Saline soils, Water quality, Rivers, *Natal, Sodium carbonate, Soil chemistry, Soil water, Rainfall, Evapotranspiration, Drainage, Alkaline soils, Mine drainage.

Irrigation water quality at 43 sites in 29 rivers in 9 catchments in Natal was evaluated, accounting for rainfall, evapotranspiration, soil drainage, and management practices. The four variables used to assess water quality were water salinity and sodicity and soil salinity and sodicity. Data were grouped according to crop salt tolerance and soil sodicity limitations. Results using this method agreed with results from the Ayers (1977) and Christiansen et al. (1977) methods for assessing irrigation water quality. Although most of the water sources were rated good for irrigation by the USSL criteria, only about half were suitable for irrigation under local conditions. The waters tested had enough sodium carbonate to reduce water quality and produce high sodicity, alkaline, soil pH, and poor internal drainage rates in the soil solution. Some of the high sodium carbonate waters had low salt levels, permitting deterioration of hydraulic conductivity in structurally unstable soils. No predominant geographical pattern in water quality was apparent. However, water quality was poorer in areas affected by mining effluents, salt-bearing geological formations, and saline groundwater. (Cassar-FRC)
W83-01826

EFFECT OF HYDRILLA MANAGEMENT BY HERBICIDES ON A PERIPHYTON COMMUNITY,
Florida Univ., Gainesville. Center for Aquatic Sciences.
For primary bibliographic entry see Field 4A.
W83-01891

THE EFFECT OF SOME SOIL SHALE PROCESS WATERS UPON THE VIABILITY OF INDICATOR BACTERIA,
Wyoming Univ., Laramie. Div. of Microbiology and Veterinary Medicine.
J. C. Adams, and D. S. Farrier.
Journal of Environmental Quality, Vol 11, No 2, p 171-174, April-June, 1982. 2 Fig, 1 Tab, 12 Ref.

Descriptors: *Bioindicators, *Oil shale, *Process water, Industrial wastewater, Bacteria, Coliforms, Streptococcus, Water pollution effects.

The possible biological effects of the release of synfuel process waters to the environment have become an area of increasing concern. It has been suggested that the enumeration of commonly accepted bacterial indicators of pollution might not be appropriate for synfuel process waters. The effects of certain oil shale process waters on total coliforms, fecal coliforms, and fecal streptococci in receiving waters were investigated. The effects of four oil shale process waters on pure cultures of members of total and fecal coliforms and fecal streptococci were studied by inoculating the organisms into various dilutions of the process waters and plating with time on selective and nonselective

media. The effect of the process waters on these organisms in freshly collected water samples was then determined by diluting the water samples with various amounts of process waters and allowing them to stand for 5 hours at 4C. These samples were then processed by standard membrane filtration procedures. The concentration and type of process water determined the effect of the process waters upon the viability of the test bacteria. The general effect of the process waters upon the test bacteria appeared to be lethal rather than injurious, although injury may be possible in some cases. The results with receiving waters suggest that process waters should be diluted at least 1 to 100 in order to minimize any adverse effects on indicator bacteria. Otherwise, underestimates of indicator bacteria are likely in waters that receive spills of the oil shale process waters. (Carroll-FRC)
W83-01915

FACTORS AFFECTING NITRIFICATION IN IOWA RIVERS,
Iowa Univ., Iowa City. Inst. of Hydraulic Research.
D. B. McDonald, and J. Huey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-167551, Price codes: A03 in paper copy, A01 in microfiche. Iowa State Water Resources Research Institute, Ames, ISWRRI Report No 108, November 1982. 21 p, 3 Tab, 1 Ref. OWRT A-071-IA(1), 14-34-0001-9017.

Descriptors: *Nitrification, Rivers, Streams, Laboratory studies, Bacteria, Wastewater disposal, *Iowa, *Nitrifying bacteria, Nitrite, Water pollution sources, Water pollution effects.

This project investigated the effects of physical and chemical factors, other than temperature, on the nitrification process. A series of laboratory studies using pure cultures of nitrifying bacteria were conducted. The effects of changes in the carbonate-bicarbonate level, suspended solids concentrations, turbulence, calcium concentration, tannic acid concentration and leaf extract on the nitrification process were evaluated. Turbulence and suspended solids concentration had no effect on the nitrite production. Nitrite produciton was 50% greater in carbonate buffered solution than solutions with no carbonate-bicarbonate buffer. Tannic acid was toxic to the nitrifying bacteria. Water extract, from oak and hickory leaves enhanced nitrification. These results will help the understanding of the nitrification process in Iowa rivers and streams and the factors that affect the rate of these processes.
W83-01952

CHALK POINT: A CASE STUDY OF THE IMPACT OF BRACKISH WATER COOLING TOWERS ON AN AGRICULTURAL ENVIRONMENT,
Maryland Univ., College Park. Dept. of Agronomy.
C. L. Mulchi, J. A. Armbruster, and D. C. Wolf.
Journal of Environmental Quality, Vol 11, No 2, p 212-220, April-June, 1982. 4 Fig, 7 Tab, 41 Ref.

Descriptors: *Cooling towers, *Brackish water, *Environmental effects, Agricultual, Soil chemistry, Air pollution, Crop yield, Corn, Soybeans, Sodium, Chlorine, Conductivity, Electric power production, *Maryland, Chalk Point.

The Potomac Electric Power Company constructed two brackish water, natural-draft cooling towers at its Chalk Point generating station, which is located in a major agricultural region in Southern Maryland. In response to concern that saline aerosol emissions from the facility might adversely affect the crops and soils near the facility, permanent research and monitoring sites were established at distances of 1.6, 4.8, and 9.6 kilometers north, south, east, and west from one of the cooling towers. Baseline data were collected for 2 years prior to the start of cooling tower operations and postoperational data were collected for 5 years. Data obtained included monthly sodium and chloride deposition rates; foliar chemistry and corn and soybean yields; soil pH and extractable potassium, phosphorus, calcium, magnesium, and sodium; and electrical conductivity values on soil samples from 0 to 15 centimeters of depth. There were no detectable changes in the sodium and chloride deposition rates above baseline values at or beyond the 1.6 kilometer sites following the start of operations. There were no significant changes in the sodium and chloride concentrations in vegetative samples collected from corn and soybean research sites following startup. Significant changes in soil chemistry parameters and significant reductions in corn yields which occurred over time following startup were associated with general increases in soil acidity and rainfall patterns rather than with salt emissions from the cooling tower. The results demonstrate that saline aerosal emissions from this natural draft cooling tower did not have a detectable impact on the agricultural crops and soils adjacent to the emission source. (Carroll-FRC)
W83-01982

SELECTED NUCLEIC ACID PRECURSORS IN STUDIES OF AQUATIC MICOBIAL ECOLOGY,
Hawaii Univ., Honolulu. Dept. of Oceanography.
D. M. Karl.
Applied and Environmental Microbiology, Vol 44, No 4, p 891-902, October, 1982. 3 Fig, 9 Tab, 34 Ref.

Descriptors: *Time series analysis, *Mathematical models, Ecosystems, *Synthesis, *Uptake, *Metabolism, *Prediction, *Radioactive tracers, *Bacteria, Algae, Natural waters, Ecology, Model studies, Synthetic hydrology, Microbiological studies, Ponds, Coastal waters, *Hawaii, Oahu, Manoa.

Several assumptions are examined that must be made when using radiolabeled nucleosides and nucleic acid bases to estimate the rates of RNA and DNA synthesis in naturally occurring microbial assemblages. Conclusions were drawn from results of experiments conducted on bacterial cultures and water samples from several marine and freshwater ecosystems as well as from pure bacterial and algal cultures. Comparative time series analyses of the uptake and incorporation, labeling specificity, and extent of catabolism of tritiated samples of 2-adenine, thymidine, and 5-uridine were studied, along with pathways of labeled thymidine and adenine metabolism. Tritiated thymidine gave the most variable results, especially with regard to the extent of nonspecific macromolecular labeling. The potential significance of the ecological data to be derived from estimates of in situ rates of nucleic acid synthesis more than justifies the amount of research effort that is needed to ensure a proper interpretation of the experimental results obtained in field investigations. (Geiger-FRC)
W83-01994

ACUTE TOXOCITY OF ORGANIC EXTRACTS OF MUNICIPAL SEWAGE SLUDGE IN MICE,
New York State Coll. of Veterinary Medicine, Ithaca.
J. G. Babish, B. Johnson, B. O. Brooks, and D. J. Lisk.
Bulletin of Environmental Contamination and Toxicology, Vol 29, No 4, p 379-384, 1982. 1 Tab, 17 Ref.

Descriptors: *Sludge, *Toxicity, Sludge disposal, Land application, Laboratory studies, Mutagenesis, Mortality, Mice, *Bioassay, *Sewage sludge, Municipal wastewater.

The usefulness of a simple bioassay was investigated for characterizing the toxicity of the organic fraction of sludges. Methylene chloride extracts of municipal sludges were evaporated and the residues redissolved in dimethyl sulfoxide (DMSO) for testing in a bacterial mutagen assay and for determination of median LD50 in mice. Animals were dosed intraperitoneally at a constant volume of 0.2 ml per mouse at sludge extract concentrations of 5.2 to 45.9 mg per ml of DMSO. Animals were treated with Boston sludge (106 and 86 revertants per mg extract to Ames Salmonella test TA1537 and TA100, respectively) and a less toxic sludge from Dallas, which had negative results in the Ames test. Median lethal doses were: Boston sludge, 23.4 per kg doses of 14.6-49.3 mg extract per kg; Dallas sludge, 46.5 mg per kg at doses of 25.3-86.0 mg extract per kg. No gross lesions were observed upon necropsy. Both sludge extracts were considered extremely toxic. The toxicity did not correlate with polychlorinated biphenyl levels (0.84 ppm and 1.00 ppm for Boston and Dallas sludges, respectively). This study points out that standards for sludge application on land must be based on a combination of analytical and biological assay, not on determination of a few indicators. (Cassar-FRC)
W83-02023

USE OF XENOPUS LAEVIS LARVAE IN 96-HOUR, FLOW-THROUGH TOXICITY TESTS WITH NAPHTHALENE,
Oklahoma State Univ., Stillwater. Dept. of Zoology.
G. E. Edmisten, and J. A. Bantle.
Bulletin of Environmental Contamination and Toxicology, Vol 29, No 4, p 392-399, 1982. 2 Fig, 2 Tab, 14 Ref.

Descriptors: *Naphthalene, *Toxicity, *Bioassay, Water pollution effects, *Frogs, Xenopus laevis, Larvae, Aromatic hydrocarbons, Organic compounds, *Bioindicators, Indicators, Sublethal effects.

Larvae of Xenopus laevis (South African clawed frog) were sensitive indicators of naphthalene toxicity in a flow-through bioassay test, suitable as an early indicator of water pollution. The 6-hour EC50 for depigmentation (change from gray to white) was 3.7 mg per liter; the 6-hour EC50 for absence of swimming, 1.7-2.3 mg per liter; the 95-hour LC50, 2.1 mg per liter. Napthalene toxocity behavior and traits were classified into 5 phases, from slightly toxic to lethal. At naphthalene levels of 0.5-1.0 mg per liter the larvae remained in Phase 1. At 3 mg per liter larvae immediately entered Phase 3 or 4, skipping Phases 1 or 2 behavior. At 4.5 per liter Phase 5 occurred within a few hours. EC50 of depigmentation was not well correlated with LC50, but predicted values of EC50 for absence of swimming were within 20% of true LC50 values. (Cassar-FRC)
W83-02024

PERSISTANCE OF FORMULATED FENITROTHION IN DISTILLED, ESTUARINE, AND LAKE WATER MICROCOSMS IN DYNAMIC AND STATIC SYSTEMS,
Ottawa Univ. (Ontario). Dept. of Biology.
For primary bibliographic entry see Field 5B.
W83-02026

SEDIMENT SUSPENSION AND RESUSPENSION FROM SMALL CRAFT INDUCED TURBULENCE,
Anne Arundel Community Coll., Arnold, MD.
H. Gucinski.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-265489, Price codes: A04 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S3-82-084, October 1982. 2 p. EPA-78-D-X0426.

Descriptors: *Suspended sediments, *Turbidity, *Boats, *Resuspension, *Light penetration, *Environmental effects, Chesapeake Bay, Submerged plants, Transmissivity, Estuarine environment, Wakes, Turbulence, Waves.

Small vessels operating in shallow waters or with wakes travelling outward to reach shallow waters may have measurable effects in producing increased turbidities as a result of the resuspension of sediments. Increased turbidity may be one of the causative factors for the widespread disappearance of submerged aquatic vegetation (SAV) in the Chesapeake Bay. A two-phase approach was used, consisting of field tests in a suitable sub-estuary of Chesapeake Bay and laboratory measurements of propeller effects. During field trials, two different vessel types were used to make passes at set speeds over known water depths. Before and after measurements of light extinction and transmission, and

determination of gravimetric suspended sediment were used to identify effects. Laboratory experiments were conducted to delineate the contribution of propellers to possible resuspension, using laser-droppler anemometry to map the turbulence field produced by propeller action. The resuspension of sediments in the path of a small craft is influenced by water depth, depth of immersion, size of the propeller, the advance ratio, and the wave-making tendency of the vessel. At depths of greater than 2 m, reduction in SAV productivity was calculated at about 1%. (Moore-SRC)
W83-02039

IMPACT OF A ONCE THROUGH COOLING SYSTEM ON THE YELLOW PERCH STOCK IN THE WESTERN BASIN OF LAKE ERIE,
Michigan Univ., Ann Arbor. School of Natural Resources.
A. L. Jensen, and T. A. Hamilton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-240284, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S3-82-072, October 1982. 2 p.

Descriptors: *Entrainment, *Impingement, *Perch, *Cooling, *Powerplants, *Environmental effects, *Mathematical models, Lake Erie, Reproduction, Biomass, Mortality, Fish populations, Fish eggs, Larvae, Cooling water, Fisheries.

Conventional stock assessment models have been applied to determine the impact of entrainment and impingement at the Monroe Power Plant on the yellow perch stock of the western basin of Lake Erie. First the surplus production model was applied. Biological parameters of the model were estimated from commercial catch and effort data, and entrainment and impingement coefficients were estimated from power plant data. The model was used to estimate stock biomass, egg production, and larvae production; the proportions entrained and impinged were then estimated. The impact of water withdrawal on the equilibrium standing stock and maximum sustainable yield from the fishery were estimated and the impacts of increased water withdrawal were simulated. An analytical model was also applied. Parameters of the analytical model was estimated using power plant data, biological data available in the literature and commercial catch data. The model was used to estimate the age structure and biomass of the perch stock and to estimate the impact of the power plant on abundance of the impingeable stock and biomass of the exploited stock. The level of impact was examined under a range of mortality conditions. The two models are much different in terms of mathematical structure and in terms of the data applied for estimation of parameters but give similar estimates of impact of about a 1% to 3% reduction in the size of the exploited stock. (Author's abstract)
W83-02040

CADMIUM AND ENDRIN TOXICITY TO FISH IN WATERS CONTAINING MINERAL FIBERS,
Environmental Research Lab.-Duluth, MN.
A. R. Carlson, J. A. Tucker, V. R. Mattson, G. L. Phipps, and P. M. Cook.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-225038, Price codes: A03 in paper copy, A01 in microfiche. Environmental Protection Agency Project Summary EPA-600/S3-82-053, October 1982. 2 p.

Descriptors: *Toxicity, *Cadmium, *Endrin, *Fish, *Asbestos, *Mine wastes, *Taconite, Biological magnification, Flagfish, Minnows, Suspended solids.

Taconite tailings and their component asbestiform minerals in Lake Superior water had no demonstrable effect on the chronic toxicity of cadmium to the flagfish Jordanella floridae. Maximum acceptable toxicant concentrations determined in life cycle tests, where effects on survival, growth, reproduction, and bioconcentration were used as endpoints, were between 3.3 to 7.4, 3.0 to 6.5, and 3.4 to 7.3 micro g cadmium/L at 0.004, 0.008, and 0.95 mg/L taconite tailings concentrations, respectively. Similarly, in two tests (A and B) exposing recently hatched fathead minnows, Pimephales promelas, for 45 days to several concentrations of endrin, taconite tailings had no observable effect on survival, growth and bioconcentration. No observable effect concentrations (NOEC(s)) for endrin at 0.02 mg/L taconite tailings concentration were between 0.30 and 0.60 micro g/L for group A fish and 0.15 micro g/L for group B fish. At 0.05 mg/L taconite tailings concentration, the NOEC(s) were between 0.30 and 0.60 micro g/L for group A fish and 0.15 and 0.30 micro g/L for group B fish. At the 0.95 mg/L taconite tailings concentration the NOEC(s) were between 0.15 and 0.30 micro g/L for group A fish and 0.30 and 60 micro g/L for group B fish. (Author's abstract)
W83-02046

EFFECTS OF RELEASES OF SEDIMENT FROM RESERVOIRS ON STREAM BIOTA,
Colorado State Univ., Fort Collins. Dept. of Zoology and Entomology.
L. J. Gray, and J. V. Ward.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-167916, Price codes: A06 in paper copy, A01 in microfiche. Colorado Water Resources Research Institute, Fort Collins, Completion Report No 116, November 1982. 95 p, 14 Fig, 3 Tab, 57 Ref, 5 Append. OWRT B-226-COLO(2), 14-34-0001-1211.

Descriptors: Reservoirs, *Sediment, *Suspended solids, *Biota, Water quality, *Colorado, *Wyoming, Benthic algae, Microinvertebrates, North Platte River.

Evaluation of temporal and longitudinal effects of sediment releases from reservoirs on downstream physical-chemical conditions, benthic algae, and macroinvertebrates was conducted at Dry Creek Reservoir No 15, Colorado, and North Platte River Guernsey Reservoir, Wyoming. In Dry Creek, flushing of sediments using stored water increased discharge, scoured stream substrates, and altered concentrations of dissolved constituents. Suspended solids increased downstream as substrates were brought into suspension. Algal abundance decreased 90%+ and did not recover for 9 months. Invertebrates were decimated with the initial release. Although full recovery was possible in 2-3 months, further releases reduced recovery rates and shifted community composition to small, fast-growing species. Upstream flows were used to flush sediments from Guernsey Reservoir. Suspended solids concentrations in the North Platte River increased from < 20 mg l- super 1 to > 300 mg l super-1. Because fine particulates remained in suspension, mean particle size of stream substrates was unaltered. Other water quality parameters were unaffected, except for an increase in phosphorus. Higher phosphorus levels contributed to an increase in benthic algae despite reduced light penetration. Densities of chironomids decreases 90%+ during sediment release from increased drift rates and mortality, but densities recovered to initial levels in 3 weeks after the release ended. Densities of mayflies and oligochaetes increased. Changes in benthic populations were highly correlated with changes in suspended solids concentrations.
W83-02061

EFFECT OF PH ON THE GROWTH AND ACTIVITY OF HETEROTROPHIC SEDIMENT MICROORGANISMS,
Waterloo Univ. (Ontario). Dept. of Biology.
M. D. Baker, W. E. Inniss, C. I. Mayfield, and P. T. S. Wong.
Chemosphere, Vol 11, No 10, p 973-983, 1982. 4 Fig, 1 Tab, 23 Ref.

Descriptors: *Acidic water, *Bacteria, *Sediments, Water pollution effects, *Hydrogen ion concentration, Lakes, *Lake sediments, Kinetics, Oxygen uptake, Mineralization, Mercury, Lead, Bisulfites, Inhibition, Acid precipitation, Heterotrophic bacteria, Turnover time, Temperature effects, Glucose, Amino acids, Heavy metals, Metals, Plastic Lake, *Ontario.

Heterotrophic microbial activity at low pH was studied in sediments taken from the acidic Plastic Lake, Dorset, Ontario, in October 1979. Oxygen uptake (microliters per g sediment) after 1 hour incubation was 60 at pH 7.5 compared with about 17 at pH 4.5. At the end of 30 min incubation oxygen uptake inhibition in the presence of metals at 60 micrograms per ml of sediment slurry was 41% (Hg) and 6% (Pb) at pH 7.5 and 57% (Hg) and 5% (Pb) at pH 4.5. Bacterial growth was completely inhibited at pH 3.5 and was 90% inhibited at pH 4.5 as compared with growth at pH 7.5. At pH 7.5 Pb at concentrations of 1, 10, and 100 micrograms per ml inhibited bacterial growth by 2, 0, and 13%, respectively. At the same concentrations and pH, Hg inhibited growth by 31, 97, and 100%, respectively. At pH 4.5 inhibition was 0, 87, and 100%, respectively, for the same concentrations of Pb and 100% for all Hg concentrations. Both low temperatures and low pH markedly increased turnover time and decreased Vmax for mineralization of C14-labeled glucose, glycine, and glutamic acid. Turnover times varied from 0.15 hours at pH 7 and 20 C (glutamic acid) to 12.22 hours at pH 4 and zero C. Vmax (micrograms substrate mineralized per g sediment dry weight per hour) varied from 0.40 at zero c and pH 4 (glycine) to 15.97 at pH 7 and 20 C. Bisulfite reduced glucose mineralization at all pH levels, slightly at 1 and 10 micrograms per ml and completely at 10,000 micrograms per ml. (Cassar-FRC)
W83-02076

ELEMENTAL COMPOSITION OF BONE FROM WHITE SUCKER (CATOSTOMUS COMMERSONI) IN RELATION TO LAKE ACIDIFICATION,
Toronto Univ. (Ontario). Dept. of Zoology.
G. A. Fraser, and H. H. Harvey.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 39, No 9, p 1289-1296, September, 1982. 2 Fig, 4 Tab, 70 Ref.

Descriptors: *Lakes, *Acidification, *Minerals, *Fish, Calcium, Manganese, Bones, White sucker, Water pollution effects, *Ontario, Acid lakes.

The mineral content of bone was measured in fish captured in three acid (pH < 5.5) and three near neutral lakes in Ontario. The manganese content of hard tissues of white suckers was also examined and related to manganese concentration in water and lake acidification. Bone was found tube decalcified in fish from three acid lakes, while manganese was increased greatly in bone of fish from the most acid lake. The mean centrum calcium content of white suckers captured in George Lake was 16% lower than in white suckers from three lakes with near-neutral pH levels. In two other acid lakes, King and Crosson, centrum calcium was reduced significantly in white suckers. Centrum manganese was elevated fivefold in white sucker from recently acidified George Lake, and tended to be elevated in this species from King Lake. White suckers from George Lake exhibited shorter caudal vertebrae, and some of these fish had deformed caudal fins. These anomalies may be indicative of bone demineralization. All of the study lakes were located in south-central Ontario, including the La Cloche Mountains, North Bay, Algonquin, Haliburton, and Muskoka. (Baker-FRC)
W83-02077

ABILITY OF STANDARD TOXICITY TESTS TO PREDICT THE EFFECTS OF THE INSECTICIDE DIFLUBENZURON ON LABORATORY STREAM COMMUNITIES,
Ecological Analysts, Inc., Concord, CA.
S. R. Hansen, and R. R. Garton.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 39, No 9, p1273-1288, September, 1982. 9 Fig, 7 Tab, 31 Ref.

Descriptors: *Organic compounds, Water pollution effects, *Population dynamics, *Benthos, *Streams, Rivers, *Diflubenzuron, *Insecticides, Agricultural chemicals, Toxicity.

The abililty of a standard set of freshwater single-species toxicity tests to predict accurately the effects of exposure to diflubenzuron on complex

laboratory stream communities was assessed. The single-species test complied with requirements prescribed for establishing freshwater quality criteria and included nine freshwater animal acute tests, five freshwater animal chronic tests, and one freshwater algal test. The stream communities were stocked from a natural source, equilibrated for 3 months and then treated with diflubenzuron for 5 months. Effects on these stream communities were assessed at the functional group level using biomass and diversity for the analysis. The single-species tests adequately predicted the concentrations of diflubenzuron which affected these stream communities; the most sensitive test species, insects and crustaceans, were up to an order of magnitude more sensitive than the observed community effects. The single-species tests were less successful in predicting the exact nature of tthe community level effects. Those effects resulting from direct lethality to component species were clearly predicted; indirect effects due to altered interspecies could only be predicted with an a priori knowledge of the system's trophic dynamics. (Baker-FRC)
W83-02079

RESPONSE OF TREE SEEDLINGS TO ACID PRECIPITATION - II. EFFECT OF SIMULATED ACIDIFIED CANOPY THROUGHFALL ON SUGAR MAPLE SEEDLING GROWTH,
State Univ. of New York Coll. of Environmental Science and Forestry, Syracuse.
D. J. Raynal, J. R. Roman, and W. M. Eichenlaub.
Environmental and Experimental Botany, Vol 22, No 3, p 385-392, 1982. 1 Fig, 5 Tab, 14 Ref.

Descriptors: *Acid rain, *Vegetation, *Environmental effects, Rainfall, Air pollution, Fallout, Trees, *Maple sugar trees, Bacteria, Forests, *Tree seedlings.

Sugar maple seedling radicle growth in a laboratory growth apparatus was significantly reduced after exposure to simulated acidified canopy throughfall at pH 3.0 and below. Seedlings exposed to low pH were susceptible to bacterial infection; survival of seedlings transplanted to soil declined with increasing acidity of simulated canopy throughfall. Extension growth and leaf weight gain of established potted seedlings subjected to acidic throughfall was dependent on soil nutrient supplying capacity. Under nutrient-limited conditions, throughfall of pH 3.0 promoted seedling growth, although causing foliar damage. At higher fertility levels, reduction in growth was found only after the pH 2.0 treatment. While these studies indicate that sugar maple seedlings are potentially susceptible to direct and indirect effects of acid precipitation, evaluation of the findings in relation to natural conditions is complicated by the capacity of vegetation and forest floor to buffer the seedling environment from extreme pH changes, the direct effects of acidity on pathogenic microorganisms and the predisposition of seedlings to infection, the episodic nature and varying acidity of precipitation, and differential sensitivity of laboratory and field grown seedlings to acidic deposition. (Baker-FRC)
W83-02091

5D. Waste Treatment Processes

MATHEMATICAL DESCRIPTION OF ADSORPTION OF IDEAL AND REAL ADSORPTIVE MATTER IN FIXED BED FILTERS - PART II (MATHEMATISCHE BESCHREIBUNG DER ADSORPTION IDEALER UND REALER ADSORPTIVE IN FESTBETTFILTERN--TEIL II),
Technische Hochschule, Aachen (Germany, F.R.). Inst. fuer Eisenhuettenkunde.
U. Krieger, and M. Mohtadi.
Gas-Wasserfach Wasser-Abwasser, Vol 122, No 12, p 582-588, December 1981, 11 Fig, 7 Ref, English Summary.

Descriptors: *Mathematical models, *Adsorption, *Filters, *Wastewater treatment, *Fixed bed filters, Costs, *Dye industry wastes, *Municipal wastewater, Biological oxygen demand, Chemical oxygen demand, Estimated costs, Biodegradation, Filtration.

A mathematical model is presented to describe adsorption processes occurring in fixed bed filters used for the treatment of organic wastewater. With this type of wastewater, purely physical adsorption is supplemented by biological degradation and mechanical filtration. These three processes are described in the model by simple equations. The model also includes an equation with eight constants that allows calculation of the degree of purification achieved for given contact and operating times. From this, the maximal specific throughput as well as treatment costs as a function of filter time and mean degree of purification achieved can be calculated. The applicability of the model was confirmed by using it to calculate purification achieved and costs for wastewater from a dye factory and for secondary effluent from a mechanical/biological municipal wastewater treatment plant. Reductions in COD and 5-day BOD calculated by the model agreed well with those actually measured. When it was assumed that approximately 50% of investment costs were a linear function of contract time, the model showed that for dye factory wastewater, purification costs decreased with increasing contact time and were at a minimum where the purification costs curve crossed the operating/investment costs curve (at contact times of up to 2 hr.). For municipal wastewater, minimum costs occurred at the adsorption stage. For a cost of 0.10 DM/cu m, 70% of 5-day BOD but only 30% of COD could be removed. It cost over 0.40 DM/cu m to remove 70% of COD. (Gish-FRC)
W83-01751

THE INFLUENCE OF FILTER GRAIN STRUCTURE ON THE BEHAVIOR OF DEEP BED FILTERS (EINFLUSS DER FILTERKORNSTRUKTUR AUF DAS VERHALTEN VON TIEFENFILTERN),
Karlsruhe Univ. (Germany, F.R.). Engler-Bunte Inst.
R. Gimbel.
Gas-Wasserfach Wasser-Abwasser, Vol 123, No 5, p 220-228, May 1982, 15 Fig, 22 Ref, English summary.

Descriptors: *Filtration, *Filter media, *Structure, Performance evaluation, *Filters, *Wastewater treatment, *Water treatment, Industrial water, Physical properties, Surface geometry, *Liquid deep bed filters.

The influence of grain structure on the performance of liquid deep bed filters is discussed on the basis of fundamental equations describing the macroscopic behavior of the filters. Equations to calculate mass balance, kinetic behavior, and pressure distribution are given, and the application of kinetic equations together with the influence of grain structure on separation processes and pressures loss are discussed. Recent deterministic theories reveal the limited applicability of conventional trajectory calculations to particle deposition. The resulting discrepancies between theory and practice, caused by idealized assumptions in the theory of transport and adhesion mechanisms, are significantly influenced by the geometric surface structure of the filter grains. Experiments on the filtration of quartz particles with filter materials of widely varying surface geometry showed that filter material with a fissured surface, such as coke or pumice, was superior, particularly in regard to its positive influence on pressure loss. The strong influence of particle adhesion was apparent in the experiments; this was especially evident with increasing filter load, and under certain conditions it became the limiting influence. Relatively smooth materials such as glass balls had a low load capacity, and occasionally parts of these broke away, especially when polymer filter aids were used. Materials such as coke and pumice are used mostly for multimedia filters, but in view of these results, replacement of quarz sand by a stronger structed material should also be considered for single medium filters. The optimization alternatives are of use for drinking, industrial, and wastewater treatment. (Gish-FRC)
W83-01752

COMPARATIVE STUDIES WITH CALCIUM AND IRON PRELIMINARY PRECIPITATION IN A TRICKLING FILTER PLANT (VERGLEICHENDE UNTERSUCHUNGEN MIT KALK- UND EISEN-VORFALLUNG AN EINER TROPFKORPERANLAGE),
Bayerisches Landesamt fuer Wasserwirtschaft, Munich (Germany, F.R.).
P. Wolf, and W. Nordmann.
Gas-Wasserfach Wasser-Abwasser, Vol 123, No 5, p 255-259, May 1982, 4 Tab, 1 Ref. English Summary.

Descriptors: *Trickling filters, *Precipitation, *Wastewater treatment, *Iron compounds, *Calcium compounds, Municipal wastewater, Phosphorus removal, Biological oxygen demand, Chemical oxygen demand, Hydrogen ion concentration, Filters, Costs.

Preliminary precipitation with calcium and iron was used in a small West German municipal trickling filter plant to improve the efficiency of wastewater treatment. Wastewater inflow to the plant contained 5-day BOD levels of 900-1,200 kg/day, with a peak level during the study period of 1,600 kg/day. To achieve the desired level of water purification, the plant should have received 5-day BOD loads of at most 600 kg/day. In dry weather, the total degree of purification achieved was 60-70%. Using preliminary precipitation with Fe(III) salts of hydrated lime, the purification level was increased to 85-95% in dry weather; however, the effect of precipitation was slight in wet weather. Due to high 5-day BOD (400-700 mg/1) and COD (600-1,100 mg/1) inflow levels, effluent levels were still 60 and 140 mg/1 for 5-day BOD and COD, respectively even with precipitation; on the day with the peak 5-day BOD inflow leel, effluent levels of 5-day BOD and COD were 130 and 205 mg/1, respectively. Despite this, daily 5-day BOD and COD concentrations in water delivered to the receiving stream were reduced from 400 to 50 kg and form 750 to 250 kg, respectively, by iron and calcium (pH 9.0) precipitation. However, with calcium precipitations the formation of calcium carbonate deposits near the dosing point necessitated reduction of the pH to 8.8, which considerably reduced precipitation efficiency. Phosphorus removal was increased from 25-30% to about 70% with calcium precipitation at approximately pH 9 and to 63% with iron precipitation. Sludge volume was increased by about 35% by both forms of precipitation, and digester gas production also increased. The estimated daily savings in cost for the plant were 200 DM for calcium and 350 DM for iron precipitation. (Gish-FRC)
W83-01759

FATE AND EFFECTS OF METHYLENE CHLORIDE IN ACTIVATED SLUDGE,
Dow Chemical Co., Midland, MI. Environmental Sciences Research Lab.
G. M. Klecka.
Applied and Environmental Microbiology, Vol 44, No 3, p 701-707, September 1982, 3 Fig, 2 Tab, 16 Ref.

Descriptors: *Biodegradation, *Activated sludge, *Methylene chloride, Wastewater treatment, Sludge, Organic compounds, Activated sludge process.

The fate and effects of methylene chloride were examined in a system that simulates a municipal wastewater treatment plant. Effects were examined both on the acclimation of activated sludge and on the rate of biodegradation. Additional studies were performed to determine the effect of methylene chloride on the degradation of a readily utilizable test substrate. Activated sludge was acclimated to methylene chloride at concentrations between 1 and 100 mg/1 by continuous exposure to the compound for 9 to 11 days. Rates of methylene chloride degradation were 0.14, 2.3, and 7. mg CH2C12 consumed per h per g of mixed-liquor suspended solids for cultures incubated in the presence of 1, 10, and 100 mg/1, respectively. Concentrations of methylene chloride between 10 and 1,000 mg/1 had no significant effect on oxygen consumption or glucose metabolism by activated sludge. A hypothetical model was developed to examine the sig-

nificance of volatilization and biodegradation for the removal of methylene chloride from an activated sludge reactor. Application of the model indicated that the rate of biodegradation was about 12 times greater than the rate of volatilization. Therefore, biodegradation may be the predominant process determining the fate of methylene chloride in activated sludge systems continuously exposed to the compound. (Baker-FRC)
W83-01769

COMPOSITION AND DEWATERING PROPERTIES OF BIOLOGICAL SLUDGES,
Missouri Univ.-Columbia. Dept. of Civil Engineering.
J. T. Novak.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-154385, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Research Center Completion Report, Columbia, Missouri, December 1982. 84 p, 18 Fig, 7 Tab, 36 Ref. OWRT A-127-MO(1), 14-34-0001-1127.

Descriptors: *Activated sludge, *Biopolymer, *Sludge dewatering, *Wastewater treatment, Molecular weight, Hydrogen ion concentration, Adsorption, *Bioflocculation.

This study was designed to determine the role of biopolymer in sludge dewatering. Free biopolymer was measured as the high molecular weight fraction (excluded by Sephadex G-50 gell) in the supernatant liquor fraction. The study showed that as the fraction of high molecular weight material increased, sludge dewatering rates decreased. This suggested that the resistance to filtration of activated sludge is due to or influenced by the high molecular weight fraction. The supernatant biopolymer also varied with pH. As the pH increased over the natural sludge pH, biopolymer levels increased. Lowering the pH reduced biopolymers. This study indicates that biological floc contains large quantities of adsorbed biopolymer. Adsorption is pH sensitive, being strongest at pH levels near 3. Treatments which reduce biopolymer levels improve sludge dewatering and selective coagulation or precipitation of supernatant biopolymer appears to be the chief role of sludge conditioning agents.
W83-01792

SOME MICROBIOLOGICAL AND CHEMICAL FACTORS INVOLVED IN BIOFLOCCULATION IN THE ACTIVATED SLUDGE TREATMENT OF TEXTILE WASTEWATER,
Auburn Univ., AL.
A. T. Mikell, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-154435, Price codes: A05 in paper copy, A01 in microfiche. M.S. Thesis, December 1981. 68 p, 11 Fig, 5 Tab, 87 Ref. OWRT A-073-ALA(3), 14-34-0001-0101.

Descriptors: Sewage, Textiles, *Microbial flocculation, *Textile wastes, Effluents, *Wastewater treatment, *Activated sludge, *Flocculation.

An activated sludge facility treating a combination of municipal sewage and waste water from a textile bleachery and dye works was examined for factors that might influence the degree of microbial flocculation and effluent quality. A microbiological examination of prevalent genera was performed to indicate the relative stability in the community structure of populations. The microscopically observable predominance of a filamentous bacterium may contribute to the consistently high SVI (250 - 500 mg/l) of the sludge. This bacterium was not isolated in pure culture or at least in its filamentous form. The virtual absence of ciliated protozoa and the dominance of the small flagellates Bodo sp. and Notoselenus sp. implicate effluent BOD values exceeding 30 mg/l according to the Curds and Cockburn scheme; however, effluent BOD values averaged less than 10 mg/l. The low effluent BOD values at this facility contrast with COD values ranging from 50 - 180 mg/l leading to unusually high COD:BOD ratios. Na super + contributed by the mill affected the settleability of sludge flocs. Settleability improved in direct proportion with the concentration of divalent cations (CaCO sub 3) as shown by jar tests. Exocellular polymer extracted from whole sludge did not differ from that reported by other workers as determined by thin layer chromatography and infrared spectroscopy. A significant variation in the proportion of ionogenic to neutral sugars on different sampling dates was observed.
W83-01800

BACTERIAL ASPECTS OF TEXTILE WASTE ACTIVATED SLUDGE BULKING,
Auburn Univ., AL.
R. L. Allen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-154443, Price codes: A05 in paper copy, A01 in microfiche. MS Thesis, December 1980. 82 p, 25 Fig, 12 Tab, 82 Ref, 1 Append. OWRT A-073-ALA(2), 14-34-0001-0101.

Descriptors: *Activated sludge, Textiles, *Microbiology, *Wastewater treatment, *Textile wastes, *Sludge bulking, *Sludge settling, Suspended solids, Bacteria, Microscopy, Municipal wastes, Wastewater treatment plants.

An activated sludge facility treating textile and municipal wastes was investigated microbiologically during periods of both normal sludge settling and sludge bulking. Samples of activated sludge from the aeration basin effluent wier, city and mill influents, and return sludge were examined microbiologically. The samples were sonicated, serially diluted and plated on enrichment media. Total viable numbers (TVN) of bacteria were determined and related to the plant parameters of mixed liquor suspended solids (MLSS), mixed liquor volatile suspended solids (MLVSS), sludge volume index (SVI), and food/microorganism ratio (F/M). Bacteria were isolated from samples obtained during both normal sludge settling and bulking periods and characterized taxonomically. The predominant genera obtained were tested for their ability to flocculate under laboratory conditions in synthetic media and sterilized wastewater. Interference contrast microscopy and scanning electron microscopy were employed in the study.
W83-01801

PLANT UPGRADING FEATURES PHOSPHORUS REMOVAL,
Howard County Dept. of Public Works, MD. Div. of Wastewater Treatment.
E. Goscicki, and R. W. Merriam.
Public Works, Vol 113, No 10, p 55-56, October, 1982. 1 Fig.

Descriptors: *Phosphorus removal, *Pho-Strip process, *Wastewater treatment, Little Patuxent Wastewater Treatment Plant, *Maryland, Microorganisms, Lime, Clarifiers.

The Pho-Strip system for phosphorus removal was incorporated into the recent $52.3 million expansion of the Little Patuxent Wastewater treatment plant in Maryland. Influent concentrations of 10 mg per liter P are reduced to < 1.0 mg per liter phosphate-P (soluble) in the secondary effluent and 0.3 mg per liter phosphate-P (total) in the tertiary filter effluents. The system, with a 15 mgd capacity, includes two 90 ft diameter anoxic strippers and two 50 ft reactor-clarifiers. The process depends on P uptake by microorganisms in the aeration basins, release of P under anoxic conditions in the stripper tanks, and subsequent lime precipitation of phosphorus in the reactor-clarifiers. (Cassar-FRC)
W83-01807

A REVIEW OF DANGEROUS GASES IN SANITARY SEWERS,
Williamsport Sanitary Authority, PA. Wastewater Div.
M. H. Gerardi.
Public Works, Vol 113, No 10, p 34-36, October, 1982. 6 Ref.

Descriptors: *Hydrogen sulfide, *Sewer gas, *Safety, Ammonia, Carbon dioxide, Methane, Oxygen depletion, Hydrocarbons, Wastewater collection, Toxicity, Ventilation, Aerobic conditions, Anaerobic conditions, Manholes.

Hydrogen sulfide poisoning and oxygen depletion are the leading causes of death for sewer workers. Other potentially lethal gases formed by microbial action in the sewers are ammonia (irritating to the eyes and respiratory system), carbon dioxide (causes asphyxiation), and methane (explosive). Gasoline and solvent vapors may be present in sewers serving industrial areas. Production of these gases depends on the composition of the wastewater, flow rate, degree of anaerobic or aerobic conditions, pH, sewer characteristics, and sewer appurtenances. The best ways to protect sewer workers from the effects of dangerous gases are to test the atmosphere before attempting to enter, ventilate the confined space, use appropriate safety equipment, and provide back-up safety personnel. A safety check list is given as an illustration. (Cassar-FRC)
W83-01809

POLLUTION AND ENERGY MANAGEMENT THROUGH THE ANAEROBIC APPROACH,
Bacardi Corp., San Jaun, PR.
L. M. Szendrey, P. E. Schafer, and G. H. Dorion.
Industrial Wastes, Vol 28, No 5, p 31-34, September/October, 1982. 2 Fig, 2 Tab.

Descriptors: *Anaerobic conditions, *Wastewater treatment, Digestion, Anaerobic digestion, Industrial wastes, Food-processing wastes, Biochemical oxygen demand, *Puerto Rico, San Juan, Distillery wastes.

Bacardi Corporation is converting distillery wastes to methane gas using an anaerobic reactor of innovative design. In December of 1981 Bacardi started up a 3 million gallon fixed media anaerobic reactor at its San Juan rum distillery, the world's largest. Currently Bacardi is the only rum producer in Puerto Rico which purifies its wastewater before discharging it into the ocean. The waste to be treated consists primarily of complex spent organic residues from still bottoms, generated by the fermentation and distillation of sugar cane molasses. Bacardi has constructed a three reactor pilot plant which treats distillery waste. Each reactor has a 3,000 gal capacity. The chief purpose of the plant is to operate in parallel with the prototype, while testing a variety of operating conditions and training operators. Experience gained thus far indicates and training operators. Experience gained thus far indicates that the operating costs are from one-fifth to one-tenth of what would be expected from a conventional aerobic system such as an activated sludge system. (Baker-FRC)
W83-01812

MAKING THE MOST OUT OF MOSTO.
Water/Engineering and Management, Vol 129, No 10, p 30-33, September, 1982. 3 Fig.

Descriptors: *Waste recovery, *Recycling, *Anaerobic digestion, *Trickling filters, Pilot plants, *Puerto Rico, Manure, Methane, Wastewater treatment, Biological wastewater treatment, Industrial wastes, Waste disposal, Water pollution control.

In the 1970's when Puerto Rico was faced with problems of rising fuel costs and tighter pollution control measures, the Bacardi Corporation, the island's largest distiller of rum, developed an innovative treatment process to handle wastes at its Catano distillery. The process is based on anaerobic waste treatment technology to produce methane gas and an effluent which can be assimilated by the Atlantic Ocean. During a month, the plant generated enough methane gas to reduce the daily oil consumption of the distillery by almost 90 barrels. The inert wastes are discharged into the Atlantic Ocean via a nearby outfall. The patented biological anaerobic filter process used begins with the transfer of mosto waste (rum slops) from the distillation towers to a holding tank, where it is chemically neutralized. From there it is passed through cooling coils and treated with other chemical before pumping to the anaerobic filter

vessel. Special plastic trickling filter media are the key to smooth functioning of the anaerobic filter. The expected life of the trickling filter is 20 years. THe process is able to go into an idling stage and quickly return to normal throughput rates. The project is being financed by AFICA, a Puerto Rican authority on environmental and medical concerns. A small team of experts is maintained to monitor the progress of the pilot operation. (Geiger-FRC)
W83-01814

MICROSCREENING EXPERIENCES,
Rexnord, Inc., Milwaukee, WI.
J. B. Cravens, and W. A. Lauritch.
Water/Engineering and Management, Vol 129, No 10, p 44-51, September, 1982. 9 Tab, 10 Ref.

Descriptors: *Separation techniques, *Screens, *Filtration, *Secondary wastewater treatment, *Tertiary wastewater treatment, *Performance evaluation, *Pretreatment of water, Wastewater treatment, Water treatment, Suspended solids, Filters, Biological oxygen demand, Advanced wastewater treatment.

Microscreening is used in water and wastewater treatment to separate solids from liquids. Rexnord Incorporated has been conducting field tests on new microscreens for lagoon (algae) and secondary treatment plant upgrading to evaluate their performance as a secondary and tertiary treatment device to maintain biological oxygen demand (BOD)-suspended solids effluent requirements. Microscreens were used to prescreen algae from reservoir water and decrease alum dosage requirements in the late 1950's. In the early 1960's, combined sewer overflow applications of microscreens began. Pulp and paper companies use microscreens to reduce suspended solids for water reuse. In 1977, an algae removal study program using microscreening was initiated across the United States. Microscreens have been used for polishing the final clarifier effluent at the Wisconsin Activated Sludge Secondary Treatment Plant at Kenosha, Wisconsin. Tests at Chesaning Secondary Treatment Plant in Michigan showed that microscreening with 21 micron media directly behind rotating biological contactors without prior clarification can handle the suspended solids loading while maintaining BOD limitations. Some advantages of microscreening over other upgrading methods are discussed. (Geiger-FRC)
W83-01817

THE CCP WAY TO BETTER EFFLUENTS,
M and I, Inc., Fort Collins, CO.
B. A. Hegg, K. L. Rakness, and J. R. Schultz.
Water/Engineering and Management, Vol 129, No 10, p 40-43, September, 1982. 1 Fig.

Descriptors: *Wastewater treatment, Wastewater facilities, *Performance evaluation, *Training, *Operating costs, Maintenance, *Design criteria, Case studies, Wastewater management, Water pollution prevention, Water pollution control, Economic aspects, Biological wastewater treatment, *Composite Correction Program.

Since the passage of the Federal Water Pollution Control Act of 1972, many wastewater pollution control plants have been constructed, and others upgraded to meet specific treatment standards. In a study of 50 western United States treatment facilities, specific problems were found in the areas of operation, maintenance, design and management. On an individual basis, each facility was affected by unique but multiple causes for poor performance. A Composite Correction Program (CCP) was formulated to address all problems that exist at a specific treatment plant. Proper CCP implementation was directly related to improve plant performance. In four case studies, the CCP was implemented at four plants with no major capital improvements. The 8 to 18 month program allowed time for operator training and adjustments in biological treatment systems. The initial step in each CCP was to establish economical performance. To assist owners in making a decision on CCP implementation, a preliminary Performance Potential Evaluation may be made. (Geiger-FRC)
W83-01821

HOW MUCH WATER CLEAN-UP DO WE WANT TO PURCHASE,
Mississippi State Univ., Mississippi State. Div. of Business Research.
L. R. Cheatham.
Mississippi Business Review, Vol XLIII, No 10, p 3-14, April 1982. 8 Tab, 8 Ref. OWRT A-131-MS(2).

Descriptors: *Economic aspects, *Cost analysis, *Water pollution control, *Legislation, *Wastewater disposal, *Industrial wastewater, Mississippi, Environmental protection, Wastewater treatment, Water quality standards, Chemical industry, Pulp and paper industry.

The Federal Water Pollution Control Amendments of 1972 (P.L. 92-500) is the Act which has probably had the greatest impact on instilling the public with an awareness that pollution control legislation produces costs which affect the consumer. The means of pollution prevention and elimination is now the application of effluent discharge standards, and discharge standards have their primary impact on point sources. Sewage disposal systems and industrial firms comprise almost all of this category in Mississippi as well as in other states. These are the units in the economy which are having to bear the direct impact of compliance costs. The burden of water pollution abatement among industrial firms is highly selective. In Mississippi, the Paper and Allied Products (SIC 26) and Chemicals and Allied Products (SIC 28) were responsible for 75.5% of all manufacturing wastewater discharges. The large volume water user groups are more likely to experience impacts from expenditures for abatement equipment because they have to spend a relatively larger percentage of investment funds for this purpose. The largest and most direct impacts of costs of complying with P.L. 92-500 are impacting Mississippi taxpaying consumers through public sewage disposal system expenditures. Compliance costs are a fact of life and are a factor to be considered in determining how much pollution abatement the taxpaying consumer wishes to purchase. (Moore-SRC)
W83-01842

INNOVATIVE FILTER POLISHES OIL REFINERY WASTEWATER,
Hydro Clear Corp., Avon Lake, OH.
J. Irwin, and M. Finkler.
Industrial Wastes, Vol 28, No 4, p 26-27, July/August, 1982. 1 Fig, 4 Tab.

Descriptors: *Oil refineries, *Industrial wastewater, *Filtration, *Wastewater treatment, Tertiary wastewater treatment, Sohio Refinery, Toledo, *Ohio, Grease, Filters, Sand filters, Flotation, Backwash, Oil wastes.

A Hydro Clear pulsed bed rapid sand filter was installed at the Sohio oil refinery, Toledo, Ohio, for polishing the facility's 10.3 mgd wastewater flow. Treatment with separation-skimming, secondary gravity separation, dissolved air flotation, activated sludge process, and clarification produces an effluent with about 20 mg per liter suspended solids (range 25-34 mg per liter). Average suspended solids in the filter effluent are 9 mg per liter (range 6-11 mg per liter). Oil and grease to the filter average 1-3 mg per liter, with removal rates of 20-35%. The filter uses a diffuser to keep the influent solids in suspension, preventing a plating-out effect and plugging of the filter surface. The filter regeneration system forces short air pulses upward through the bed to regenerate the media surface and prolong time between backwashes. The backwash system operates at very low rates (12 gpm per sf) and short duration (3.5 min) and produces 80% less spent backwash water. A separate backwash control system clarifies the spent water and uses chemicals to clean out residual grease and oil. (Cassar-FRC)
W83-01844

STATUS REPORT ON ABATEMENT OF WATER POLLUTION FROM THE CANADIAN PULP AND PAPER INDUSTRY (1980),
Environmental Protection Service, Ottawa (Ontario). Water Pollution Control Directorate.

For primary bibliographic entry see Field 5G.
W83-01886

AEROBIC ON-SITE SYSTEMS STUDIED IN NEW MEXICO,
New Mexico Environmental Inst., Las Cruces.
R. Asbury, and C. Hendrickson.
Journal of Environmental Health, Vol 45, No 2, p 86-87, September/October, 1982. 2 Tab.

Descriptors: *Septic tanks, *Aerobic treatment, *Wastewater treatment, *New Mexico, Surveys, Equipment failure.

A survey of 24 New Mexico homes revealed that on-site aerobic disposal systems have more problems than standard septic tank units. Eighteen units were not operating at the time of the survey. Several homeowners reported odor, noise, and mechanical problems. A list of 12 inspections made at a time of home loan applications indicated that 8 were not operating because of equipment failure. These factors indicate that septic tanks have advantages over aerobic systems at sites suitable for subsurface discharge. (Cassar-FRC)
W83-01893

MILWAUKEE METROPOLITAN SEWERAGE DISTRICT, WISCONSIN,
Milwaukee Metropolitan Sewerage District, WI. Treatment Services Div.
S. P. Graef.
Journal of the Water Pollution Control Federation, Vol 54, No 10, p 1432-1434, October, 1982. 2 Tab.

Descriptors: *Water treatment facilities, *Wastewater treatment, Activated sludge process, Sludge dewatering, Municipal wastewater, *Wisconsin, Milwaukee, Effluents, Water quality.

The Treatment Services Division of the Milwaukee Metropolitan Sewerage District administers the operation and maintenance of the 530,000 cubic meter/day Jones Island Wastewater Treatment Plant and 380,000 cubic meter/day South Shore Wastewater Treatment Plant. The monitoring of wastewater, effluent, sludge, solids, and the lawn and turf fertilizer Milorganite come under the control of this district. Also, the utilization and handling of waste materials in the form of filter cake, sludge, and Milorganite must be supervised. Currently facing the district is involvement in the $1.6 billion Water Pollution Abatement Program. Steps which will be taken at the wastewater treatment plants to ensure compliance with the effluent quality standards are cited. (Baker-FRC)
W83-01894

ANAEROBIC-FILTER PRETREATMENT KINETICS,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
B. E. Rittmann, C. E. Strubler, and T. Ruzicka.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No EE5, p 900-912, October, 1982. 9 Fig, 3 Tab, 11 Ref.

Descriptors: *Anaerobic conditions, *Filters, *Kinetics, Biochemical oxygen demand, Anaerobic digestion, Wastewater treatment, Suspended solids, Fermentation.

Pilot studies conducted with synthetic and actual dairy wastewater showed that anaerobic-filter pretreatment at ambient temperature was capable of reducing total BOD by up to 96%. Analysis of the reactor kinetics showed that the reactions were complete in about two days detention time, which corresponded to a volumetric loading of 1.7 kg COD/cubic meter per day. Because of declining margical removals with increased detention time, simple kinetic expressions were not appropriate representations of the reactor performance. Fermentative reactions dominated during the first 0.75 days of treatment, while methanogenic reactions dominated thereafter. Although effluent quality deteriorated, the anaerobic filters could handle a severe shock load as long as sufficient alkalinity

had been added to keep the pH above 6.8 throughout the reactor. (Baker-FRC)
W83-01897

ADSORPTION ISOTHERM PARAMETER ESTIMATION,
Indianapolis Public Works Dept., IN. Liquid Waste Div.
M. W. Sweeney, W. A. Melville, B. Trgovcich, and C. P. L. Grady, Jr.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No EE5, p 913-922, October, 1982. 2 Fig, 3 Tab, 6 Ref.

Descriptors: *Estimating, *Isotherms, *Adsorption, Wastewater treatment, Water treatment, *Langmuir equations, Thermocline, Temperature gradient, *Freundlich equations, Mathematical equations, Least squares method, Mathematical studies.

Determination of the parameter values for the Langmuir and Freundlich adsorption isotherm equations for water and wastewater treatment samples often requires estimation of the concentration of nonadsorbable material. Present techniques for estimating the concentration of the material can introduce bias into the data. Furthermore, linearization of the isotherm equations usually leads to application of least-squares analysis to variables other than the true dependent and independent variables. A nonlinear programming technique is presented which allows simultaneous evaluation of the concentration of nonadsorbable material and the isotherm parameters. The technique is based upon the flexible polyhedron concept and achieves minimization of the sum of squares error term associated with the solute concentration when expressed as a function of the adsorbent concentration. (Baker-FRC)
W83-01898

MAXIMIZING ALGAL YIELD IN HIGH-RATE OXIDATION PONDS,
Ben-Gurion Univ. of the Negev, Sde Boker (Israel). Jacob Blaustein Inst. for Desert Research.
G. Oron, and G. Shelef.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No EE4, p 730-738, August, 1982. 3 Fig, 1 Tab, 13 Ref.

Descriptors: *Oxidation ponds, *Algae, Economic aspects, *Wastewater treatment, Aquaculture, *Retention time, Water depth, *Israel, Wastewater irrigation, Optimization, Ponds.

A procedure for determining the best combination of retention time and effluent depth in operating high rate oxidation ponds is described. Data was obtained from pilot and field ponds in Israel and from computer simulations. These parameters are related to sensitivity of the system to light penetration into the pond, the efficiency of biodegradation, the rate of algal growth, algal washout, ambient temperature, and the criteria for reuse of effluent. The objective of the system is maximum net income. The practical range for retention time is 1.8-8 days and for depth 0.2-0.9 m, producing a retention time/pond depth ratio of 6-12. The financial return on the algae sold as animal feed varies from 3 to 4.5
W83-01899

SCRUBBING ODORS FROM WASTEWATER TREATMENT,
Yarmouk Univ., Irbid (Jordan). Dept. of Civil Engineering.
A. B. M. Shahalam.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No EE4, p 785-799, August, 1982. 4 Fig, 4 Tab, 8 Ref.

Descriptors: *Odor control, *Scrubber systems, *Sewer gases, Wastewater treatment, Hydrogen sulfide, Sodium hypochlorite, Sodium hydroxide.

A sewage odor treatment method using a two-stage chemical wet scrubber system was tested in pilot plant studies. The odorous gases, obtained from the wet well of 180 mgd domestic sewage treatment plant, were first passed through a sodium hypochlorite solution (concentration, 0.1-0.23%, optimum, 0.1%) and then through sodium hydroxide solution at pH 10.5-11.6. Odors were reduced by 85-95%. Odor intensity was a function of sewage temperature and oxidation-reduction potential; it was not dependent on sulfide concentration. The effluent air, characterized by gas chromatography-mass spectrometry, contained aliphatic hydrocarbons and chlorinated hydrocarbons at the ppb and ppt levels. Measurements of hydrogen sulfide in the effluent air on several occasions indicated levels of 0-2 ppm. Hydrogen sulfide levels were not correlated with threshold odor, and therefore sodium hypochlorite requirements cannot be based solely on hydrogen sulfide concentrations. (Cassar-FRC)
W83-01900

CHARACTERISTICS OF FILL-AND-DRAW REACTOR,
Sigma Resource Consultants Ltd., Vancouver (British Columbia).
R. Zapf-Gilje, and D. S. Mavinic.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No EE4, p 808-812, August, 1982. 4 Fig, 3 Tab, 11 Ref.

Descriptors: *Leachates, *Biological wastewater treatment, *Fill-and-draw reactors, Wastewater treatment, Batch reactors, Laboratory equipment, Landfills, Metals, Settling velocity, Organic loading.

Two removal systems governed fill-and-draw reactors, widely used for investigation of biological treatability of wastewater. Zero-order metal oxidation dominated the initial 1/6 of the cycle and microbial growth the remainder. Landfill leachates (13,640 mg per liter BOD and 19,250 mg per liter COD) were used in 6-liter reactors with fill-and-draw cycles of 12 hours and 24 hours. During each leachate addition there was a transition period of 1/4 the cycle time, after which the system recovered. By the end of the first 1/4 of the cycle organic removal and metal oxidation were virtually complete. Both mixed liquor pH and mixed liquor dissolved oxygen dropped immediately after feeding, a result of metal oxidation, and rose to normal after metal oxidation was complete. Settling characteristics of the mixed liquor were poor throughout the study, a result of sludge bulking (nonfilamentous) and deflocculation following feeding and hindered settling from high mixed liquor suspended solids concentrations (8,800 mg per liter). Poor settling, characteristic of the fill-and-draw system, results from the shock on the starved microbial population when high strength feed is suddenly added. (Cassar-FRC)
W83-01901

COST-EFFECTIVE PRETREATMENT PROGRAMS,
Environmental Protection Agency, Cincinnati, OH.
For primary bibliographic entry see Field 5G.
W83-01903

ACTIVATED CARBON: SORPTION OF DOC FROM WASTEWATER,
Brown and Caldwell, Pasadena, CA.
F. S. Cannon, and P. V. Roberts.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No EE4, p 766-783, August, 1982. 6 Fig, 7 Tab, 29 Ref.

Descriptors: *Activated carbon, *Organic carbon, *Adsorption, Wastewater treatment, Effluents, Filtrasorb, Aquanuchar, Pores, Physical properties, Prune pit charcoal.

Activated carbons were prepared from prune pits by pyrolysis at 900 C from 15 to 60 min. These carbons were compared with commercial activated carbons with respect to specific surface area, pore volume distribution, and dissolved organic carbon (DOC) adsorption from filtered secondary wastewater effluent. Specific surface areas (sq m per g) were 663-1692 for prune pit char, 998 for Filtrasorb 400 (F400), 897 for Filtrasorb 100 (F100), and 810 for Aquanuchar A. Pore volumes (cu cm per g) were 0.363-0.930 for te prune pit char, 0.641 for F400, 0.596 for F100, and 0.596 for Aquanuchar. In the prune pit char the specific surface area and pore volumes increased with increasing activation time. Calculated partition coefficients were: F400, 56,700 g DOC adsorbed per g DOC in solution; prune pit charcoals, 18,300-94,900. Dissolved organic carbon uptake into powdered activated carbon behaved according to a model based on linear equilibrium and rate-controlled by pore diffusion. About 1 mg per liter (10%) of the DOC in the effluent was nonadsorbable by activated carbon regardless of dosage. Adsorbents F400 and the prune pit charcoal activated for 60 minutes behaved similarly in DOC adsorption. Apparent diffusion coefficients (times 10 to the minus 10th power sq m per sec) for DOC were 1.3 for F400 and 1.0, 1.6, and 2.9 for prune pit charcoals activated for 30, 42, and 60 minutes, respectively. (Cassar-FRC)
W83-01904

TREATMENT OF SALINE DOMESTIC WASTEWATER USING RBCS
New Hampshire Univ., Durham. Dept. of Civil Engineering.
N. E. Kinner, and P. L. Bishop.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, VOl 108, No EE4, p 650-664, August, 1982. 8 Fig, 3 Tab, 25 Ref.

Descriptors: *Saline water, *Biological wastewater treatment, Seawater, Wastewater treatment, Rotating biological contactors, Hydraulic loading, Biofilms, Islands, Appledore Island, New Hampshire.

Poor performance of a rotating biological contactor treating variably saline wastewater from a 100-person island treatment plant prompted a pilot scale evaluation of the process. Variation in salinity, from fresh water to 20,000 mg per liter salt, and changes in disk media (plastic or Masonite) produced no significant differences in effluent quality ($<$ 20 mg per liter BOD), which was adequate for discharge into marine or fresh receiving waters. Mean COD removals were 61% and 64% at hydraulic loading rates of 0.04 and 0.08 cu m per sq m per day, respectively. At higher loading rates (0.33 cu m per sq m per day) organic removal dropped to 10%. Results indicated that the treatment problems at the plant were not caused by high salinity wastewater. It was recommended that the present 47.4 sq m of substrate available for biofilm attachment be increased to 186-372 sq m, depending on the loading rate. The May to October operation of the facility also necessitates an annual acclimatization period. This could be shortened by starting the yearly operation with fresh water based sewage from a nearby municipal plant. (Cassar-FRC)
W83-01907

EVALUATION OF SLUDGE DEWATERING ALTERNATIVES AT A METALLURGICAL REFINERY,
Teledyne Wah Chang, Albany, OR.
W. A. Crocker.
Journal of the Water Pollution Control Federation, Vol 54, No 10, p 1417-1424, October, 1982. 1 Fig, 9 Tab, 14 Ref.

Descriptors: *Sludge dewatering, *Activated sludge process, *Sludge disposal, Wastewater treatment, Waste disposal, Dewatering.

Experimental data and equipment design obtained from sludge dewatering pilot studies performed during the last half of 1978 are presented. Four different, commercially available machines were evaluated: a rotary-drum vacuum filter, a belt filter press, a recessed-plate filter press, and a solid bowl centrifuge. They were compared according to the following criteria: estimated capital cost for a complete dewatering system; delivery time for a properly designed machine; operating costs, including

power, chemicals, labor, maintenance, and disposal; and dryness of the wet cake and its suitability for hauling and disposal. The rotary drum vacuum filter and recessed plate filter press were eliminated from consideration because they exhibited low filtration rates. The belt filter press and the solid bowl centrifuge successfully dewatered the metal hydroxide sludge. The solid bowl centrifuge had lower estimated capital and operating costs, required less operator attention and maintenance, consumed less of the chemicals, and had a shorter delivery time. The belt filter press produced a much dryer cake, which would be substantially easier to handle, store and dispose of. The belt filter press generated much less sludge, significantly reducing storage requirements and hauling/disposal costs. (Baker-FRC)
W83-01933

SEASONAL TREATMENT AND VARIABLE EFFLUENT QUALITY BASED ON ASSIMILATIVE CAPACITY,
Stanley Consultants, Inc., Atlanta, GA.
For primary bibliographic entry see Field 6F.
W83-01935

STORMWATER POLLUTION CONTROL: STRUCTURAL MEASURES,
Santa Clara Univ., CA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5G.
W83-01944

WASTEWATER TREATMENT IN SOIL AS A FUNCTION OF RESIDENCE TIME IN THE ROOT ZONE,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Engineering.
W. L. Magette, E. R. Collins, and V. O. Shanholtz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-167536, Price codes: A05 in paper copy, A01 in microfiche. Virginia Water Resources Research Center Completion Report, Blacksburg, November 1982. 95 p, 14 Fig, 27 Tab, 36 Ref. OWRT A-088-VA(2).

Descriptors: *Land application, *Wastewater disposal, *Effluent irrigation, Land treatment design, *Nitrate pollution, Percolation, SPAW model, Soil water model, *Root zone, *Soil water movement, Simulation, Sandy loam.

A laboratory study was conducted in an effort to establish a relationship between residence time of land applied wastewater in the root zone and the degree to which nitrogen is removed from the wastewater. Each of sixteen soil samples of a Cecil gravelly sandy loam (Typic Hapludult; clayey, kaolinitic, thermic) was placed in an environmental chamber and seeded to tall fescue at the rate of 22.5 kg/ha. These samples simulated actual field conditions. Soil water (and wastewater) movement through the root zone under wet conditions (50-75% saturated) were described with the aid of a digital simulation model. A procedure was developed to predict the rate and volume of drainage as a function of initial soil moisture content, amount of liquid applied, and time after liquid application. An exact relationship between nitrogen removals and wastewater residence time in the root zone could not be developed. However, removals of up to 95% of applied NH4(+)(-)N were observed in an 18-cm deep root zone with residence times as short as 2 hours. Recommendations are made for future investigations, including types of soils and the use of more sophisticated monitoring equipment (such as dual gamma ray attenuation).
W83-01950

FLOC PROPERTY EFFECTS ON SLUDGE DEWATERING CHARACTERISTICS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5E.
W83-01957

NITRIFICATION RATES IN ACTIVATED SLUDGE,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
J. H. Sherrard, D. K. Manning, and D. A. Smith.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers Vol 108, No EE5, p 1074-1078, October, 1982. 4 Fig, 3 Tab, 4 Ref.

Descriptors: *Nitrification, *Activated sludge process, *Stoichiometric analysis, Sludge, *Wastewater treatment, Nitrigen, Oxygen demand, Biomass.

A stoichiometric analysis was made of the nitrification process under steady-state conditions. Based on this study it was concluded that for a given wastewater, the nitrifier fraction is not a constant and is dependent on the mean cell residence time and the COD:TKN ratio. The percentage of nitrifiers present in an activated sludge biomass did not have an effect on the rate of nitrification. (Baker-FRC)
W83-01959

CONSIDERATIONS IN MODELING ACTIVATED SLUDGE PROCESS,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
G. E. Speitel, Jr., and M. M. Hughes.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No EE5, p 990-1002, October, 1982. 5 Fig, 3 Tab, 6 Ref.

Descriptors: *Activated sludge process, *Wastewater treatment, *Model studies, Sludge, Mathematical studies, *Design criteria, Water treatment facilities, Construction.

Mathematical modeling of the activated sludge process is examined both from a unit process viewpoint and as an integral component of plant-wide mass balance models. Two modeling approaches are reviewed. The first is a standard approach now commonly used in practice. The second is an alternative approach which represents a modification of the first to directly account for influent suspended solids to the activated sludge process. Considerations are presented as to the proper application of both models in the prediciton of waste sludge production and mixed liquor concentration. The two approaches also are compared for utility in wastewater treatment plant design. The alternative approach may be more flexible in accounting for sludge handling recycle loads. In many instances it also provides a more conservative estimate of waste sludge production. (Baker-FRC)
W83-01960

FACT SHEET FOR WASTEWATER TREATMENT,
D. V. Feliciano.
Journal of the Water Pollution Control Federation, Vol 54, No 10, p 1346-1348, October, 1982. 5 Tab.

Descriptors: *Data collections, *Wastewater treatment, Construction, Grants, Municipal wastewater, Water treatment facilities, Nonpoint pollution sources, Pollution load.

A collection of various facts concerning water pollution control is presented to aid the researcher in preparing papers which may require some of this information. Facts are given concerning existing municipal wastewater treatment plants - including both performance and flow statistics; treated effluent discharges; year 2000 municipal wastewater treatment plants' performance and flow data; status of municipal treatment facilities; and the fiscal year breakdown of the construction grants program from 1973 through June of 1982. (Baker-FRC)
W83-01962

COMPARISON OF FINAL CLARIFIER DESIGN TECHNIQUES,
Greeley and Hansen, Chicago, IL.
T. E. Wilson, and J. S. Lee.
Journal of the Water Pollution Control Federation, Vol 54, No 10, p 1376-1381, October, 1982. 3 Fig, 2 Tab, 16 Ref.

Descriptors: *Design criteria, *Clarifiers, *Wastewater treatment, Mathematical equations, Activated sludge process, Effluents, Sludge thickening, *Settling velocity.

The fundamental relationships and differences between the limiting flux theory and the initial settling velocity technique (SV) as used in the design of activated sludge final clarifiers are discussed. The approach taken in the study uses the mathematical technique developed to represent the limiting solids flux theory. The surface overflow rate, a clarifier design parameter, was calculated using both techniques for a mixed liquor having a relationship between the initial settling velocity and MLSS. The effect of the return ratio on the results was also investigated. A safety factor concept was established and used to modify the ISV technique. Two design examples were presented for the purpose of comparison. The results obtained provide a useful tool for the plant operator, who can use a single ISV test to determine whether or not his plant is flux limited at any given moment. (Baker-FRC)
W83-01963

OXYGEN ACTIVATED SLUDGE DESIGN FOR INDUSTRIAL AND MUNICIPAL WASTES,
Black and Veatch, Kansas City, MO. Process Control Dept.
J. R. Stukenberg.
Journal of the Water Pollution Control Federation, Vol 54, No 10, p 1382-1387, October, 1982. 3 Fig, 4 Tab, 4 Ref.

Descriptors: *Activated sludge process, *Design criteria, *Wastewater treatment, Mathematical equations, Sludge, *Oxygen, Municipal wastes, Water treatment facilities, Missouri, Kansas City.

The process design for the liquid phase of the expanded treatment plant, particularly the HPOAS system, is described. Information is presented relating the use of conventional complete mixing activated sludge mathematics to the high purity oxygen activated sludge system. Specification for performance testing of the oxygenation equipment is also discussed. The process design dealt with the strength and variability of the waste as well as the nutrient deficiency of the waste. Using complete mixing activated sludge (CMAS) mathematics and oxygen transfer relationships, it was possible to determine the aeration basin detention time, the quantity of oxygen to be transferred to the wastewater and the power requirements for dissolution of the oxygen. It was possible using equipment manufacturer input to determine the capacity of the oxygen generating equipment and the parameters needed for specification and testing of the surface aeration equipment. (Baker-FRC)
W83-01964

PARTICLE BEHAVIOR IN GRAVITY THICKENING,
Texas Univ. at Austin. Dept. of Civil Engineering.
D. F. Lawler, P. C. Singer, and C. R. O'Melia.
Journal of the Water Pollution Control Federation, Vol 54, No 10, p 1388-1400, October, 1982. 6 Fig, 7 Tab, 28 Ref.

Descriptors: *Sludge thickening, *Design criteria, *Activated sludge process, *Wastewater treatment, Sludge, Sludge dewatering, Particle behavior.

Particle behavior was studied in the thickening of slurries with heterodisperse particle sizes. Evidence is presented, based on particle size distribution measurements, that coagulation and differential sedimentation occur during batch thickening. These phenomena that occur at the microscopic level influence macroscopic settling behavior. The extent to which these phenomena occur is shown to be dependent on the initial particle size distribution, surface characteristics of the particle, and concentration. The implications of these findings for research to understand the thickening theory as to the design and operation of continuous thickeners were considered. (Baker-FC)
W83-01965

REALISTIC SLUDGE PRODUCTION FOR ACTIVATED SLUDGE PLANTS WITHOUT PRIMARY CLARIFIERS,
M and I, Inc., Fort Collins, CO.
J. R. Schultz, B. A. Hegg, and K. L. Rakness.
Journal of the Water Pollution Control Federation, Vol 54, No 10, p 1355-1360, October, 1982. 8 Fig, 1 Tab, 15 Ref.

Descriptors: *Wastewater treatment, *Sludge, *Activated sludge processes, Clarifiers, Effluent, Water pollution control, *Water treatment facilities.

Nearly 200 wastewater treatment plants were evaluated to determine plant operability and define plant performance-limiting factors. Actual sludge production data were presented for 16 well operated activated sludge plants without primary clarifiers. The average sludge production coefficient for all plants was 0.86 kg TSS/kg BOD-R. Of this total, only 10% was discharged in the plant effluent. Sludge production and wasting requirements varied considerably both between plants and also within a single plant for different periods. Cell yield coefficients that address only biological solids growth should not be used as estimates of total sludge production. Design of sludge handling facilities should include capabilities to handle sludge wasting at levels of at least 150% of design for several months. Adequate sludge handling facilities can contribute significantly to achieving and maintaining a high quality effluent from small activated sludge plants without primary clarifiers. (Baker-FRC)
W83-01966

RELATION OF INFLOW/INFILTRATION COSTS TO VARYING POLICY REQUIREMENTS,
National Semiconductor Corp., Santa Clara, CA.
For primary bibliographic entry see Field 5G.
W83-01969

IN SITU STUDIES WITH MEMBRANE DIFFUSION CHAMBERS OF ANTIBIOTIC RESISTANCE TRANSFER IN ESCHERICHIA COLI,
California Univ., Davis. Dept. of Genetics.
M. R. Altherr, and K. L. Kasweck.
Applied and Environmental Microbiology, Vol 44, No 4, p 838-843, October, 1982. 3 Fig, 5 Tab, 36 Ref.

Descriptors: *Escherichia coli, *Sewage bacteria, *Wastewater treatment, *Coliforms, *Membrane processes, *Resistance, Bacteria, Enteric bacteria, Wastewater pollution, Effluents.

The ability to transfer antibiotic resistance to Escherichia coli K012 C600 was examined in coliform bacteria isolated from raw sewage and sewage effluent-receiving waters. An environmental isolate of E. coli (MA527) capable of transferring antibiotic resitance to C600 was mated, both in vitro and in situ, with an antibiotic-sensitive E. coli environmental isolate (MA728). In situ matings were carried out in modified membrane diffusion chambers in the degritter tank at the Grant Street (Melbourne, Florida) sewage treatment plant and in sewage effluent-receiving waters in Melbourne, Florida. Higher transfer frequencies were observed in virto than in situ. Transfer was presumed to have occurred if lactose-negative colonies grew after 24 to 48 hr of incubation at 37 degrees on double inhibitor-supplemented Mac Conkey agar. Transfer was observed in raw sewage but not in effluent-receiving waters. The transfer of antibiotic resistance in situ was ascertained by the presence of a 60-megadalton plasmid species in both donor and transconjugants. (Geiger-FRC)
W83-01996

COMPUTER ANALYSIS OF SETTLING TEST DATA,
Wisconsin Univ.-Madison. Dept. of Civil and Environmental Engineering.
P. M. Berthoux, and D. K. Stevens.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No EE5, p 1065-1069, October, 1982. 2 Fig, 3 Tab, 3 Ref.

Descriptors: *Computers, *Analysis, *Settling, *Flocculation, Sedimentation, Suspended solids, Fate of pollutants, Chemical coagulation, Dispersion, *Wastewater treatment.

A method of analyzing test data is presented which can serve for either discrete or flocculant settling. The method is based on fitting a simple approximating polynomial to the test data and using the fitted function for calculations. The method is simple, and is easily implemented. It is the mathematical equivalent of physically using a French curve to derive a simple, smooth function from the data. It can be used with the data as either concentrations or percentages. The use of concentration data is illustrated. (Baker-FRC)
W83-02035

WASTEWATER REUSE ENHANCEMENT BY USE OF IMMOBILIZED CHELATORS,
Bjorksten Research Labs., Inc., Madison, WI.
R. U. Schenk.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-167841, Price codes: A03 in paper copy, A01 in microfiche. Office of Water Research and Technology, Focused Research Series OWRT/RU-82-9, January 28, 1982. 34 p, 7 Fig, 13 Ref. OWRT C-00168-R(0527)(1), 14-34-0001-0527.

Descriptors: *Chelating agents, *Wastewater renovation, *Cadmium, *Industrial wastewaters, Wastewater treatment, Heavy metals, Water reuse, Electroplating, Metal-finishing wastes, Resins.

Heavy metal ion contamination of industrial wastewaters seriously reduces the reuse capabilities of the water. Two commercially available chelating resins and a laboratory synthesized experimental resin were tested in the laboratory for removal of toxic heavy metal ions and subsequent extraction and recycling. Cadmium was selected for primary study because of its high toxicity and current environmental concerns. Cadmium was extracted from industrial wastewaters both in the laboratory and in an electroplating plant. Cadmium levels of 0.01 ppm or less were obtained in treating the effluent of the acid sulfate plating wastewaters in the pilot sized plant test. Removal by the resin, extraction from the resin and subsequent recycling of the cadmium were found to be practical with the commercial resins, Cellulex UR and Chelex-100. The cellulose derived carbonyl sulfonate experimental resin was found to have essentially no capacity for cadmium extraction, so it appears to have little potential for being developed as a resin to be incorporated in an extraction belt. The continuous belt extractor tested lowered the cadmium level of the solution substantially. However, the retained solution on the belt caused appreciable spreading of the cadmium, not only into the acid bath but also into the rinse solutions. A wringer to press out the entrained water would appear to be necessary to achieve an effective process. (Moore-SRC)
W83-02054

LONG-TERM CAPACITY FOR ORGANIC-SUBSTRATE REMOVAL BY BACTERIAL FILMS,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
B. E. Rittmann, and C. W. Brunner.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-167999, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Center Research Report No 172, University of Illinois, Urbana-Champaign, October 1982. 53 p, 21 Fig, 3 Tab, 20 Ref. OWRT A-108-ILL(1), 14-34-0001-1115.

Descriptors: *Biodegradation, *Biofilms, *Kinetics, *Mathematical modeling, *Trace organics, Model studies, *Wastewater treatment, Organic wastes.

When wastewater is discharged to small streams, the effluent quality normally obtained from a sewage treatment plant is often not good enough to prevent serious water-quality deterioration. Hence, enhanced removal of organic pollutants is required. Efficient and economic removal of organics to very low concentrations is best achieved by biofilm processes, in which bacteria are attached to a fixed media and remove the organic compounds from the wastewater flowing past. Laboratory-scale reactors were utilized to evaluate the ability of biofilms to remove low levels of organic contaminants in water during extended operation. Nonsteady-state operation, in which trace concentrations of organic substrate were treated with a biofilm previously grown on a relatively high concentration feed, demonstrated that a slowly decaying biofilm was able to bring about high efficiency removal of the trace compound for extended periods, up to 7 months in this study. A Kinetic model to describe the transient growth and decay of the biolfim was developed, and it predicted the growth and steady-state phases of the biofilm when input parameters were detemined independently. The observed slow decay rate of the biofilm prolonged the usefulness of the nonsteady-state biofilm and was explained by adaptation to oligotrophic (low concentration) conditions and the growth of nitrifying bacteria which produced supplemental organic substrate to sustain the organic-utilizing bacteria. The results of this study demonstrated that nonsteady-stable-biofilm processes can sustainably achieve organic concentrations much lower than conventional wastewater treatment.
W83-02069

SUBSTRATE REMOVAL AND SLUDGE PRODUCTION IN A BATCH ACTIVATED-SLUDGE PROCESS WITH BLENDING,
Windsor Univ. (Ontario). Dept. of Civil Engineering.
R. L. Droste, and J. K. Bewtra.
Canadian Journal of Civil Engineering, Vol 9, No 3, p 558-566, 1982. 6 Fig, 4 Tab, 12 Ref.

Descriptors: *Activated sludge process, *Mixing, *Wastewater treatment, Sludge, Chemical oxygen demand, Suspended solids, Oxygen uptake, Flocculation, Settleability.

The effect of mechanical blending of mixed liquor from the aeration chamber on the performance of both phases of the activated sludge process was investigated. Bench-scale studies were conducted in which the mixed liquor was blended periodically in an Osterizer blender. A similar unit without mechanical blending was operated as a control. Synthetic organic feed of known characteristics was used as substrate. Tests were conducted for mixed liquor volatile suspended solids (MLVSS), effluent chemical oxygen demand (COD), settleability, and oxygen uptake rate under steady-state conditions. Substrate uptake in both units was observed to be a rapid adsorption-absorption phenomenon. The nonremovable COD was significantly lower in the blended unit. Also, the oxygen uptake rates showed significant increases due to floc breakup. Settleability was good in the blended unit, and the overall effluent quality had improved considerably. (Baker-FRC)
W83-02080

TEMPERATURE EFFECT ON THE ANAEROBIC TREATMENT OF POTATO-PROCESSING WASTEWATER,
New Brunswick Univ., Fredericton. Dept. of Civil Engineering.
K. C. Lin, R. C. Landine, and S. Bliss.
Canadian Journal of Civil Engineering, Vol 9, No 3, p 549-557, 1982. 9 Fig, 2 Tab, 13 Ref.

Descriptors: *Wastewater treatment, *Temperature effects, *Anaerobic digestion, Anaerobic lagoons, Aerated lagoons, Chemical oxygen demand, Suspended solids, Filters, Food processing wastes, Food processing industry, *Potato-processing wastes.

An attempt was made to determine the efficiency of an anaerobic lagoon-filter model in treating a potato-processing effluent at temperatures below 20C. The waste was unsettled primary clarifier influent from a food processing plant. Removals of chemical oxygen demand, suspended solids, as well

as sludge buildup in the lagoon and gas production were examined. The system, buffered with lime, was fed continuously. Detention times were 7.0 and 1.5 days for the lagoon and filter, respectively. The loading rate was 0.35 kg COD/(cubic m/day), based on lagoon volume. There was 100% recycling but no sludge wastage. Between 10 and 20C the system removed about 94% of the COD and 95% of the SS. Down to 4C removals of 85% COD and 93% SS were obtained. At 2C system failure was imminent. The sludge accumulation rate was highest at 6C, four times the rate at 20C. Total methane production varied from 0.35 cubic m/kg COD removed at 20C down to 0.24 cubic m/kg COD removed at 4C, with a 62% decrease in volumetric rate. Methane content in the gas was 75-84%. The filter had a higher methane production-to-COD removal ratio and a higher methane content than the lagoon. (Baker-FRC)
W83-02081

5E. Ultimate Disposal Of Wastes

COMPOSITION AND DEWATERING PROPERTIES OF BIOLOGICAL SLUDGES,
Missouri Univ.-Columbia. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W83-01792

SECURING AN ABANDONED HAZARDOUS WASTES SITE,
O'Brien and Gere Engineers, Inc., Syracuse, NY.
W. V. Blasland, Jr., W. H. Bouck, E. R. Lynch, and R. K. Goldman.
Industrial Wastes, Vol 28, No 5, p 19-22, September/October, 1982. 4 Fig.

Descriptors: *Hazardous wastes, *Land disposal, *Dumping, Waste disposal, Vegetation, Plant growth, Vegetation establishment, Revegetation, Fort Miller, *New York, Industrial wastes, Municipal wastes.

The General Electric Company and the New York State Department of Environmental Conservation signed a major agreement in which a corporation agreed to pay for remedial action to clean up abandoned hazardous waste dump sites at seven locations. One of the sites in the agreement was Fort Miller, located about 7.5 miles south of Hudson Falls, New York. This site was an open municipal/industrial dump operating as a burning dump between 1953 and 1965. Field studies indicated that there were two groundwater zones at the site, a shallow perched zone at the clay/refuse interface and a permanent one at a depth of 3 to 20 feet below grade. The recommended remedial program is in-place containment of wastes, to include a clay cap with vegetative cover, a relocated surface drainage system, a leachate collection system and a gas venting system. At present all surface runoff is collected in a series of drainage channels along the toe of the site. The fill placed during regrading operations will cover the existing channels, and new channels will be built. Since the impermeable cap over the site will eliminate percolation of surface water into the refuse, the source of additional leachate will be removed, and the existing leachate should be collected and disposed of within an estimated six months to one year following cap installation. (Baker-FRC)
W83-01811

LYSIMETERS FOR SIMULATING SANITARY LANDFILLS,
Technische Univ., Brunswick (Germany, F.R.). Leichtweiss Inst. for Water Research.
H-J. Collins, and P. Spillmann.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No EE5, p 852-863, October, 1982. 5 Fig, 3 Tab, 11 Ref.

Descriptors: *Lysimeters, *Landfills, Waste disposal, *Leaching, Percolation, Leachate.

Various decomposition processes inside sanitary landfills are being studied. Eight different modes of operation of sanitary landfills will be simulated by special lysimeters during the course of the study. These lysimeters consist of flexible walls, which allow settlements similar to that to nature to occur. Thermal insulation of the lysimeter protects the biological and chemical processes against outside temperatures. The leachate is collected separately from different compartments in the base, and samples of seepage are drawn from different levels. The lysimeters allow taking samples of refuse or the inserting of material at different places and levels. The density of the refuse in the lysimeter filled according to today's practice is in the range usually encountered in practice, while mixing of the refuse or refuse and sludge increases the density considerably. After aerobic decomposing, sieving, and compacting, the required deposition volume was one-third compared to the present common practice. After five years of study it was noted that leachate forms before the material is saturated. As a consequence of this and by interpreting the accumulated outflow of the lysimeter it can be stated that the quantity of outflow will increase after the operation of a sanitary landfill has ended. (Baker-FRC)
W83-01908

SLUDGE UTILIZATION AND DISPOSAL IN VIRGINIA,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agronomy.
D. C. Martens, G. D. McCart, R. B. Reneau, Jr., T. W. Simpson, and T. Ban-Kiat.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-167510 , Price codes: A06 in paper copy, A01 in microfiche. Virginia Water Resources Research Center Completion Report, Blacksburg, October 1982. 107 p, 14 Tab, 209 Ref. OWRT A-097-VA(1).

Descriptors: *Sewage Sludge, *Land Application, *Sludge Disposal, Wastewater Treatment, *Sludge Treatment, Sewage Treatment plants, Agronomy, Agriculture, Fertilizers, Nitrogen, Phosphorus, *Virginia, Literature reviews, Research needs, Research priorities.

This state-of-the-art study was initiated to determine the problem issues, present knowledge about the issues, and additional research needs in the area of land disposal of municipal sewage sludge. Three questionaires were developed to survey technically oriented professional, county extension agents, and Virginia NPDES permit holders to obtain these groups' views on problems and deficiencies needing further investigation. Another phase of the study was to conduct an extensive review of the literature on the subject of land application of sewage sludge. Listings of pertinent literature relating to land application with specific interest toward potentially toxic metals, pathogens, nitrogen, and phosphorus were obtained and reviewed. Additional research is needed in the following areas: a method that accurately estimates metal availability within the soil; a method to determine the potential for a disease outbreak from controlled application of treated municipal sewage sludge; a more precise method of N-balancing; the impact of P loading on water quality.
W83-01948

FLOC PROPERTY EFFECTS ON SLUDGE DEWATERING CHARACTERISTICS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
W. R. Knocke, and D. L. Wakeland.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-167601, Price codes: A04 in paper copy, A01 in microfiche. Virginia Water Resources Center Bulletin 133, Blacksburg, December 1982. 72 p, 21 Fig, 4 Tab, 32 Ref. OWRT A-091-VA(1).

Descriptors: *Sludge floc, *Sludge dewatering, *Sludge handling, *Floc density, Sludge filtrate viscosity, Floc compressibility, Floc strength, Particle size distribution, *Sludge disposal, Biopolymer content, *Sludge treatment, Virginia, Filtration.

The technical and economic problems associated with sludge handling and disposal have increased in recent years because of (1) the introduction of more strigent water and air pollution regulations and (2) the development of regulations that stipulate the means of ultimate disposal of sludge residues. These regulations have resulted in the need to produce sludges with both good dewatering characteristics and low water content to minimize the ultimate volume of solids that require disposal. The objective of this study was thus to examine the fundamental parameters that affect sludge dewatering characteristics. Included are analyses of both sludge dewatering and sludge handling characteristics. Parameters include floc size shape and density; sludge viscosity and shear strength; and floc compressibility. Both water and wastewater sludge samples were collected from full-scale treatment plants in Virginia and were analyzed for each of the above-mentioned parameters. They were then subjected to dewatering studies using laboratory-scale vacuum filtration, sandbed, and filter press equipment. Sludge handleability was evaluated through the standard Atterburg liquid limit test procedure. Three main conclusions can be drawn from this study: (1) Particle size distribution is a key parameter for describing the response of sludges to each of the dewatering methods used, although other factors, such as biopolymer content, apparently have a major effect on the dewatering characteristics of biological sludges. (2) Sludge floc density has a direct correlation to the ultimate solids concentration obtained by vacuum filtration. (3) The use of high-pressure filtration provides more appropriate information on water content than the centrifugation method.
W83-01957

CURRENT MUNICIPAL SLUDGE UTILIZATION AND DISPOSAL,
Duke Univ., Durham, NC. Dept. of Civil and Environmental Engineering.
J. J. Peirce, and S. Bailey.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No EE5, p 1070-1073, October, 1982. 3 Fig, 1 Tab, 3 Ref.

Descriptors: *Waste disposal, *Sludge disposal, *Sludge utilization, Municipal wastes, Data collections, Wastewater treatment, Surveys.

An overview is presented of the research and results of an inventory being made on municipal sludge utilization and disposal practices. Data collection activites included telephone interviews to identify key individuals and corresponding addresses within the Public Owned Treatment Works (POTW) service area, followed by the mail-out of data collection sheets and subsequent lengthy telephone interviews to transmit data collected on site. In all, 1,008 POTW's were contacted and 2,299,729 dry metric tons per day of sludge were accounted for . Seven basic technologies are adopted for sludge utilization and disposal. To varying degrees, seven basic sludge disposal methods are used across the nation. Sixty-four percent of all POTW's relied on a single method sludge disposal. Distribution and marketing was practiced widely, but was not relied upon as the major disposal method for most POTW's. About 80% of the distribution and marketing of these POTW's uses two more disposal options. Disposal and marketing is not generally relied upon as the critical disposal technology in the sludge disposal plans at most POTW's. (Baker-FRC)
W83-01958

PARTICLE BEHAVIOR IN GRAVITY THICKENING,
Texas Univ. at Austin. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W83-01965

CHEMICAL PROPERTIES AND MINERALOGICAL CHARACTERISTICS OF SELECTED DREDGED MATERIAL,
Wisconsin Univ.-Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 5B.
W83-01970

MONITORING OF A MUNICIPAL SLUDGE ENTRENCHMENT SITE,
Agricultural Research Service, Beltsville, MD. Biological Waste Management and Organic Resources Lab.
For primary bibliographic entry see Field 5B.
W83-01972

WATER REGIME AND NITROGEN FERTILIZATION FOR RHODES GRASS IRRIGATED WITH MUNICIPAL WASTE WATER ON SAND DUNE SOIL,
Volcani Inst. of Agricultural Research, Bet-Dagan (Israel). Inst. of Soil and Water.
I. Vaisman, J. Shalhevet, T. Kipnis, and A. Feigin.
Journal of Environmental Quality, Vol 11, No 2, p 230-232, April-June, 1982. 2 Fig, 3 Tab, 10 Ref.

Descriptors: *Wastewater irrigation, *Nitrogen removal, *Crop yield, Optimal yield, Fertilizers, Municipal wastewater, *Wastewater disposal, *Land disposal, Groundwater pollution, Water supply, Soil profiles.

Irrigating crops with treated municipal wastewater can increase the water supply and reduce the need for fertilizer. However, the water and fertilizer needs of the particular crops must be known in order to minimize water loss and the potential for groundwater pollution. The water requirements and fertilizer needs of Rhodes grass (Chloris gayana Kunth), a high-yielding perennial forage crop, were investigated in field experiments on a sand dune soil during 1978 and 1979. The grass was irrigated with municipal effluent that had received secondary treatment in settling ponds. Four sprinkler irrigation regimes were used, each at two levels of additional nitrogen fertilizer. The wastewater effluent contained about 18 milligrams of nitrogen per liter, which did not supply the full needs of the crop. The addition of 250 kilograms of nitrogen per hectare as ammonium sulfate ((NH4)2SO4) resulted in an optimum dry matter yield of 12.0 metric tons per hectare when irrigation was applied on the basis of a Class A pan evaporation factor of 0.8. Very little or no deep seepage occurred with this treatment, while higher rates of effluent application resulted in the soil profile remaining wet below a depth of 60 centimeters. Greater nitrogen application levels resulted in the loss of nitrogen in the drainage water from the plots. The Rhodes grass proved to be an efficient remover of nitrogen from the effluent, preventing both deep seepage and groundwater pollution when the irrigation water was applied at appropriate levels. (Carroll-FRC)
W83-01975

AMMONIA-OXIDIZING BACTERIA POPULATIONS AND ACTIVITIES IN SOILS IRRIGATED WITH MUNICIPAL WASTE WATER EFFLUENT,
Kimberly-Clark Corp., Neenah, WI.
K. M. Chopp, C. E. Clapp, and E. L. Schmidt.
Journal of Environmental Quality, Vol 11, No 2, p 221-226, April-June, 1982. 4 Fig, 5 Tab, 10 Ref.

Descriptors: *Municipal wastewater, *Bacteria, *Land disposal, *Soil bacteria, Nitrification, Irrigation, Soil water, Nitrates, *Wastewater disposal, Wastewater irrigation, Population dynamics, Biological oxidation, *Minnesota, *Ammonia-oxidizing bacteria.

Properly managed application of treated municipal wastewater effluents to agricultural land may provide nutrients and water to crops and recharge groundwater supplies without adverse environmental effects. The effects of effluent treatment on the populations and activities of ammonia-oxidizing bacteria in the treated soil were investigated during one corn growing season in Minnesota. Fluorescent antibody techniques were used to enumerate soil populations of one serotype each of the ammonia-oxidizing genera Nitrosomonas, Nitrosolobus, and Nitrosospira. Populations of these three bacteria fluctuated only slightly over the entire growing season. Each genus peaked at a separate time. Higher effluent treatments resulted in slightly smaller populations of these bacteria than either fertilized control or low effluent treatments. Ammonia oxidation activity was significantly higher for soils receiving higher rates of effluent. Soil nitrogen levels showed sharp decreases in ammonium nitrogen when the population of ammonia-oxidizing bacteria peaked in June, but began to accumulate in the fall when these populations declined. Both effluent treatment and time significantly affected the concentration of nitrate-nitrogen in the soil. Nitrate-nitrogen concentrations in soil water and groundwater varied with effluent treatment and time, with the peak concentrations occurring about 1 month after the peak N03-N concentrations in the soil. (Carroll-FRC)
W83-01976

PREDICTED SOLUTION PHASE FORMS OF HEAVY METALS IN SEWAGE SLUDGE-TREATED SOILS,
Agricultural Research Service, Tucson, AZ.
W. E. Emmerich, L. J. Lund, A. L. Page, and A. C. Chang.
Journal of Environmental Quality, Vol 11, No 2, p 182-186, April-June, 1982. 4 Fig, 3 Tab, 24 Ref.

Descriptors: *Heavy metals, *Sludge disposal, *Soil solution, Soil columns, Solutes, Cadmium, Copper, Nickel, Zinc, *Land application, Chemical properties, *Computer programs, Soil profiles, *GEOCHEM computer program.

The chemical forms of heavy metals in soil solutions can significantly affect the movement of those metals through the soil matrix. Total metal concentrations were determined in the soil solutions of soil columns treated with sewage sludge and leached over a 25 month period. The GEOCHEM computer program was used to evaluate the chemical forms of cadmium, copper, nickel, and zinc in the soil solutions and to determine the changes with depth in the chemical forms of these metals in the soil solutions. Although the total concentrations of the four heavy metals in the soil solutions were elevated by the sewage sludge additions, in most cases they were still within ranges found in survey of untreated soils. The metal concentrations in the soil solutions were so low that they made only a negligible contribution to metal movement during the course of the study. Data on metal complexes in the soil solutions were used to group the metals into free ionic and organic and inorganic complexed forms. Between 50 and 60 percent of the cadmium, 50 and 70 percent of the nickel, and 60 and 70 percent of the zinc in solution was found to be in the free ionic form. Copper was almost exclusively in organically complexed forms in the sludge soil layers and shifted somewhat to free ionic form with decreasing pH at greater depths below the sludge incorporation layer. In all cases, the metal concentrations in the soil solution for the sludge incorporation layer were significantly higher than those below the sludge soil interface. The addition of sewage sludge to the soils increased the activity of the metals in the soil solution of the sludge incorporation layer. The metals in soil solutions were generally undersaturated, at least with respect to the soluble mineral phases studied, and the solid phase that is controlling the metal activity is not known. (Carroll-FRC)
W83-01977

SOLID PHASE FORMS OF HEAVY METALS IN SEWAGE SLUDGE-TREATED SOILS,
Agricultural Research Service, Tucson, AZ.
W. E. Emmerich, L. J. Lund, A. L. Page, and A. C. Chang.
Journal of Environmental Quality, Vol 11, No 2, p 178-181, April-June, 1982. 5 Tab, 6 Ref.

Descriptors: *Heavy metals, *Soil columns, *Sludge disposal, *Land application, Digested sludge, Cadmium, Copper, Nickel, Zinc, Solids, Chemical properties.

Heavy metals in the solid phase of soils or sewage sludge treated soils occur in many chemical forms, and the form taken can greatly influence the fate of the metal in terms of plant uptake or soil profile migration. The solid phase chemical forms of cadmium, copper, nickel, and zinc in sludge soil mixtures which had been subjected to long-term incubation and leaching were investigated using a sequential extraction procedure. The applied sewage sludge, untreated soil samples, and treated soil samples were fractionated into the designated forms of exchangeable, adsorbed, organically bound, carbonated, and residual. The metals added to the soil had not moved out of the sludge-soil incorporation layers during 25 months of leaching. A comparison of the chemical forms of the metals present in the sludge-soil layers at the termination of the leaching process with those initially present in the sewage sludge and in the soil showed that cadmium, nickel, and zinc were all shifting to the residual form, while the form of the copper (mostly organically bound) did not change significantly during the study. The occurence of metals in the stable organically bound, carbonate, and residual forms in the sludge, coupled with a shift toward the more stable form after soil incorporation, contributed to the lack of metal movement found in the soil profiles. (Carroll-FRC)
W83-01978

MOVEMENT OF HEAVY METALS IN SEWAGE SLUDGE-TREATED SOILS,
Agricultural Research Service, Tucson, AZ.
For primary bibliographic entry see Field 5B.
W83-01980

DISPOSAL OF FEEDLOT LAGOON WATER BY IRRIGATING BROMEGRASS: I. CROP REMOVAL OF NITROGEN,
Kansas Agricultural Experiment Station, Manhattan. Dept. of Agronomy.
R. V. Olson, R. V. Terry, W. L. Powers, and C. W. Swallow.
Journal of Environmental Quality, Vol 11, No 2, p 267-272, April-June, 1982. 3 Fig, 4 Tab, 16 Ref.

Descriptors: *Nitrogen removal, *Wastewater irrigation, *Bromegrass, Crop yield, Land disposal, Feedlot wastes, Wastewater lagoons, Performance evaluation.

Nitrogen removal efficiency is an area of considerable concern when using soils and crops as agents for the disposal of waste waters from feedlots and municipal sewage plants. The effectiveness of bromeglass (Bromus inermis) in removing nitrogen from beef feedlot lagoon water was investigated in field plots irrigated at four rates in three replications over a 4 year period. Microplots within the main plots for two treatments received lagoon water enriched with nitrogen-15. Bromegrass was harvested two or three times each year, with yields and total nitrogen uptake determined for the main plots and yields, total nitrogen uptake, and lagoon water nitrogen uptake determined for the microplots. Although yields and total nitrogen uptake increased with irrigation rates, the excessive moisture on the stands of grass resulted in decreases in yields and total nitrogen uptake with time. When stands were maintained through reseeding, yields increased with time. Applications of 2.5 and 5.1 centimeters of lagoon water resulted in the removal of more total nitrogen than was applied, but higher irrigation levels resulted in the removal of less total nitrogen than that applied. The highest irrigation rate (10.2 centimeters) resulted in 1.8 times more uptake of lagoon water nitrogen than the 5.1 centimeter treatment. Although the percentage of lagoon water nitrogen removed increased with time, it appeared to be leveling off at about 40% after 4 years. Bromegrass is not the best crop to use for removal of nitrogen from lagoon water, since excessive moisture results in reduction of stands of this crop. Low rates of application of lagoon water provide more satisfactory results, since they leave less lagoon water nitrogen in the soil than high irrigation rates and result in the uptake of more total nitrogen than that present in the applied wastewater. (Carroll-FRC)
W83-01981

ADSORPTION OF REOVIRUS BY MINERALS AND SOILS,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 5B.
W83-01995

5F. Water Treatment and Quality Alteration

THE INFLUENCE OF FILTER GRAIN STRUCTURE ON THE BEHAVIOR OF DEEP BED FILTERS (EINFLUSS DER FILTERKORNSTRUKTUR AUF DAS VERHALTEN VON TIEFENFILTERN),
Karlsruhe Univ. (Germany, F.R.). Engler-Bunte Inst.
For primary bibliographic entry see Field 5D.
W83-01752

DETERMINATION OF MUTAGENIC ACTIVITY IN SALMONELLA OF RESIDUAL FULVIC ACIDS AFTER OZONATION,
Department of National Health and Welfare, Ottawa (Ontario). Environmental and Occupational Toxicology Div.
D. J. Koowbel, E. R. Nestmann, M. Malaiyandi, and R. Helleur.
Water Research, Vol 16, No 11, p 1537-1538, November 1982, 1 Tab, 13 Ref.

Descriptors: *Ozonation, *Water treatment, *Fulvic acids, *Water reuse, *Podzols, *Assay, Salmonella, Ozone, Chlorination, Chlorine, Chloroform, Humic acids, Recycling, Prince Edward Island, Canada, Ames assay.

The mutagenic potential of residual products derived from ozonation of fulvic acids was studied in ozonated soil and water samples using the Ames Salmonella/mammalian microsome assay. Soil fulvic acid was extracted from a Bh horizon podzol soil from Prince Edward Island, Canada, while water fulvic acid was isolated from a shallow pond in Parkland near Ottawa. Results of the mutagenicity tests showed that all but one sample of ozonated residues of fulvic acid was negative in the standard Salmonella plate tests using 5 bacterial strains. A highly ozonated soil fulvic acid extract showed a 1.8-fold increase over background mutagenicity levels in strain TA100 only and did not require microsomal activation for the weak mutagenic response observed. The implications of these findings on the treatment of recycled water for potable uses are discussed. (Geiger-FRC)
W83-01757

AEROBIC AND ANAEROBIC MICROORGANISMS IN TUBERCLES OF THE COLUMBUS, OHIO, WATER DISTRIBUTION SYSTEM,
Ohio State Univ., Columbus. Dept. of Microbiology.
O. H. Tuovinen, and J. C. Hsu.
Applied and Environmental Microbiology, Vol 44, No 3, p 761-764, September 1982, 3 Tab, 10 Ref.

Descriptors: *Water distribution, *Pipelines, *Bacteria, *Public health, Columbus, *Ohio, Water quality, Water conveyance, Drinking water, Water supply, Corrosion, Disinfection, Chlorine, *Microorganisms, *Tubercles, Ion compounds.

Aerobic and anaerobic microorganisms were counted in tubercles collected from sections of the water distribution pipeline in Columbus, Ohio, metropolitan area. Coliform bacteria were not detected in the tubercles examined. Sulfate-reducing bacteria were detected in 80% of the samples. Nitrate-reducing heterotrophs were present in all samples. The findings, including plate counts of aerobic heterotrophs, indicated variation in bacterial densities depending on the tubercle sample and fraction examined. The associations among the viable counts obtained by the different culture methods were statistically analyzed. The high counts of different bacterial groups suggest that there are zones in the tubercle mass that contain enough organic compounds and other nutrients to support the development of various types of microorganisms. Microcosms may exist in which symbiotic relationships such as nutrient cycling contribute to high numbers of diverse organisms. (Baker-FRC)
W83-01770

PUBLIC WATER SUPPLY QUALITY IN THE ROCK RIVER WATERSHED, SOUTHWEST MINNESOTA,
Minnesota Univ., Minneapolis. School of Public Health.
C. P. Straub, V. M. Goppers, and R. D. Singer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-154369, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Center, Bulletin 110, University of Minnesota, St. Paul, October 1982. 54 p, 29 Fig, 1 Tab, 11 Ref. OWRT A-038-MINN(2).

Descriptors: *Minnesota, Water quality, *Municipal water supplies, Groundwater quality, Public health, Surface water quality, Anions, *Rock River watershed, Seasonal changes, *Drinking water standards.

Several municipal water supplies in the Rock River watershed in Southwestern Minnesota were tested on approximately a monthly basis for a little over two-years for the anions nitrate-nitrogen, sulfate, chloride, and bicarbonate alkalinity as calcium carbonate, and for total dissolved solids, conductivity, and pH. Anions were selected for analysis because it was felt that they were better descriptors of the effect of land use practices on ground water quality. The ratios of the various anions sulfate-nitrate-nitrogen, chloride/nitrate-nitrogen, sulfate-chloride, and bicarbonate alkalinity as calcium carbonate-sulfate served to identify changes in water quality not associated with dilution. Findings indicated seasonal changes in water quality not necessarily reflected in changes in the ratios, generally increasing concentrations of nitrate-nitrogen in many instances, exceeding permissible concentrations specified in the Interim Primary Drinking Water Standards, and high dissolved solids concentrations generally exceeding recommended levels specified in the Secondary Drinking Water Standards. Ground water concentrations were compared with surface water samples from the several streams, springs, and lakes in the area. Some relations to land use practice on ground water quality and precipitation were indicated. The data have been utilized to call attention to deficiencies in water quality to the consumers of the waters in the communities concerned.
W83-01790

COMPARATIVE STUDIES ON THE EFFICIENCY OF VARIOUS BACKWASH SYSTEMS IN GRANULAR FILTRATION PLANTS (VERGLEICHENDE UNTERSUCHUNGEN UBER DIE WIRKSAMKEIT VON VERSHIEDENEN RUCKSPULSYSTEMEN BEI KORNMASSENFILTERN),
WABAG G.m.b.H. and Co. KG, Kulmbach (Germany, F.R.).
W. Kretzschmar.
Gas-Wasserfach Wasser-Abwasser, Vol 123, No 5, p 229-234, May 1982. 9 Fig. English summary.

Descriptors: *Gravity filters, *Backwash, *Bank washing, *Continuous flow washing, *Water treatment, Filters, Costs, Construction costs, Sludge, Filtration.

Rapid gravity filters, usually constructed from concrete, have been used successfully in water treatment for many years. Their advantages include efficient use of available surface, resistance to corrosion, and adaptability. Two backwash systems, bank washing and continuous flow washing, came into use with the introduction of multimedia filters. These systems were tested by an extensive series of experiments for their efficiency, i.e., the ratio of pollutants extracted to the amount of backwash water consumed. The experiments revealed that the two systems did not differ in water consumption or sludge water volume, though there were differences in pollutant extraction at certain backwash speeds. Construction costs were generally similar, though continuous flow systems using new construction techniques were the most economical. Before deciding upon a backwash system, the purpose of the filter should be defined, and consideration should be taken of whether it will be single or multimedia, whether reaction space is required, the hydraulic influence of the filter matter, intensity of sludge formation, backwash speed, and integration into an existing hydraulic system. (Gish-FRC)
W83-01805

WATER PLANT EXPANSION SUCCESSFULLY COMBINES THE OLD AND THE NEW,
P. R. Boller.
Public Works, Vol 113, No 10, p 37-39, October, 1982.

Descriptors: *Construction, *Expansion, *Water treatment, Three Rivers Treatment Plant, Aesthetics, Ft. Wayne, *Indiana, St. Joseph River.

The Three Rivers Water Treatment Plant, Fort Wayne, Indiana, was expanded to 72 mgd average (90 mdg maximum) in 1981. The plant now consists of three treatment facilities operating in parallel. Originally built in 1934 (capacity 24 mgd) and increased to 48 mgd in the 1950's, the plant uses St. Joseph River water as the raw water source. The most recent addition retained the character of the original structure, noted for its Gothic architecture and stone carvings. Energy conservation and operating efficiency were incorporated into the plant expansion, in particular, horizontal, turbine-type mixers in the flocculation chambers, a liquid carbon dioxide system for recarbonation, flexibility in operation, and a modern control room. The severe floods of 1982 did not interrupt service to customers in spite of the plant's location on low, unstable soil near the river. Flood damage was prevented by the 12,000 piles used as support and thick reinforced concrete construction for underground tanks. (Cassar-FRC)
W83-01808

TREATED WATER FOREVER PURE,
East Bay Municipal Utility District, Oakland, CA.
K. B. Stinson.
Water/Engineering and Management, Vol 129, No 10, p 34, 36, 71, September, 1982. 3 Ref.

Descriptors: *Water treatment, *Distribution reservoirs, *Drinking water, *Water conveyance, *Water storage, *Reviews, *Corrosion control, *Organoleptic properties, Potable water, Storage tanks, Water pollution prevention, Scaling, Color, Bacteria Odors, Fouling, Pipes.

The quality of source water, construction materials of distribution systems, and methods of construction and operation may all contribute to the deterioration of the quality of treated drinking water. For example, deposits of aluminum or iron salts may occur in waters of systems where these agents are used as coagulants to reduce color and turbidity. The adjustment of pH for corrosion prevention may cause high levels of aluminum to pass through filters. The addition of lime to adjust pH may also increase water turbidity. Intermittent increases in flow due to fires, main breaks or changes in demand may stir up sediments and shield bacteria from disinfection measures. Scaling may occur as deposits of calcium carbonate, iron oxides, manganese oxides, silicates or alumina build up in distribution systems or customers' piping. Some new synthetic coatings used to prevent corrosion of distribution materials may impart bad taste and odor qualities and support the growth of bacteria. Gasoline and mercaptans have been known to permeate plastic water services and cause taste and odor problems. Excess sunlight in distribution reservoirs may cause algal growth. Human and bird excreta may also find its way into open reservoirs. Contaminants may enter the system when a flooded air release valve draws a vacuum during a main break or fire. Effective backflow prevention devices are necessary to prevent contamination. Main tapping operations can inject pipe material into distribution systems. If normally closed valves are not exercised periodically, the buildup of contaminants may accelerate corrosion. (Geiger-FRC)
W83-01815

SPOKANE'S BLUE LAGOON,
Spokane City Dept. of Public Utilities, WA.
R. E. Saty.
Water/Engineering and Management, Vol 129, No 10, p 38, 40, September, 1982.

Descriptors: *Storage reservoir, *Reservoirs linings, *Membranes, *Elastomers, *Economic aspects, Water storage, Reservoir storage, Reservoirs, Reservoir operation, Drinking water, Rubber, *Washington, Spokane.

To meet EPA, state and local regulations on water quality, the 24-million-gallon Lincoln Heights Reservoir was recently upgraded. City engineers decided to line the reservoir with a 45-mil thick black flexible membrane and cover it with a specially designed 45-mil thick blue colored floating cover. The cover system, called Rooflost, is made of three 15-mil sheets of synthetic rubber encapsulating a reinforcing fabric. Down time was kept to a minimum while upgrading the reservoir. The Hypalon lining will remain flexible and elastic over a wide range of temperature. An elastomeric compound was used for strong seaming. A blue cover was chosen for aesthetic purposes, since the reservoir was adjacent to a retirement community and a city park. The cover reduces the amount of sunlight hitting the reservoir, thereby hindering algal growth, chlorine degradation, and evaporation. The floating cover also helps reduce the chances of accidental drowning. (Geiger-FRC)
W83-01816

MICROSCREENING EXPERIENCES,
Rexnord, Inc., Milwaukee, WI.
For primary bibliographic entry see Field 5D.
W83-01817

CARBON SOLVES NEW JERSEY WATER-WELL POLLUTION CRISIS.
World Water, Vol 5, No 9, p 16, 29, 31, September, 1982.

Descriptors: *Water treatment, *Drinking water, *Carbon absorption, Odor, Taste, Well water, Wells, Diisopropyl ether, Methylene chloride, Tetrachloroethylene, Rockaway, *New Jersey.

The identification of diisopropyl ether and methylene chloride in drinking water samples in Rockaway Township, New Jersey required emergency steps to be taken. The source of the pollution was traced to a local gasoline station with a leaking storage tank. The construction of a treatment plant was ordered, while potable water stations were established for collection of supplies by individual inhabitants. THe system chosen called for pollutant removal through carbon absorption. In nearby Rockaway Borough a well showed traces of tetrachloroethylene and was closed down. However, within months the contamination had reached 554 ppb of PCE, and there was concern about other nearby wells. A similar carbon absorption system was installed to meet this emergency situation, and in both communities the problems were resolved. (Baker-FRC)
W83-01819

AGUA DEL PUEBLO BOOSTS QUALITY OF RURAL GUATEMALAN LIFE.
World Water, Vol 5, No 9, p 49, 51-53, September 1982.

Descriptors: *Water quality, *Public health, *Water resources development, Sanitation, Drinking water, Contamination, Rural areas, Rural sociology, Training, Education, *Guatemala.

Over 50 rural water supply projects were constructed in rural Guatemala through the efforts of a nonprofit technical assistance group, Agua del Pueblo. This approach to rural water and sanitation problems has from the outset involved training of talented local people to assist in the planning and construction of village systems. Extensive community involvement in virtually every aspect of a project is the guiding principle of the methodology. Through an extensive education program workers from the Aqua del Pueblo movement explain the superior benefits of house connections versus public taps. Water committees are the key to successful participatory water projects. They become responsible for collection of maintenance fees and loan payments from families and for repaying loans to the water program. (Baker-FRC)
W83-01839

INTERACTION OF HYDROLOGIZED AL AND POLYELECTROLYTE COAGULANTS,
Syracuse Univ., NY. Dept. of Civil Engineering.
R. D. Letterman, and P. Sricharoenchaikit.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No EE5, p 883-899, October, 1982. 11 Fig, 1 Tab, 17 Ref.

Descriptors: *Chemical reactions, *Coagulants, *Turbidity, Water quality, *Polyelectrolytes, *Aluminum, Acidity, Water treatment.

A laboratory jar test study was conducted to determine the mode of action of commercial cationic polyelectrolytes used in combination with aluminum salt coagulants. Electrophoretic mobility and residual turbidity data were collected as a function of coagulant dosage, solution chemistry, and the particle size distribution and concentrations of the silica particle suspension. Two general types of results were obtained, depending on the tendency of the hydrolyzed aluminum to form a flocculent precipitate. This tendency is a function of the solution chemistry, including pH, concentrations of adsorbing anions such as sulfate, and ionic strength. With dilute solutions and low pH the aluminum hydrolysis products tend to be stable, and under these conditions the cationic polyelectrolyte and the adsorbed hydrolyzed A1 have similar effects on particle stability. Maximum turbidity removal is observed near an electrophoretic mobility of zero. A simple trade-off relationship exists between the amounts of A1 and polyelectrolyte required to reach this point. When the aluminum hydrolysis products are flocculent a coating of aluminum hydroxide precipitate is apparently formed on the particles, which, as the aluminum concentration is increased, eventually controls particle stability and the efficiency of flocculation. (Baker-FRC)
W83-01896

CALIFORNIA'S SMALL WATER SYSTEMS PROGRAM: INSPECTIONS UP 60%; MAJOR DEFICIENCIES DOWN 37%,
San Bernardino County Dept. of Environmental Health Services, CA.
R. L. Roberts, and J. S. McGurk.
Journal of Environmental Health, Vol 45, No 2, p 80-82, September/October, 1982. 4 Fig.

Descriptors: *Inspection, *Interagency cooperation, *Water treatment facilities, Training, Education, *California, Public health, Grants.

Cooperation between California's state and local health agencies has resulted in an effective program for inspecting small water systems. As a result of this program, systems with major deficiencies have decreased from 38.9% in 1977-78 fiscal year to 22.5% in 1980-81 fiscal year among community systems and from 32.5% to 23.3% among non-community systems. The systems having no deficiencies increased from 20.9% to 32% among community systems and from 33.2% to 39% in non-community systems. Of the 10,806 systems in the program, 5960 were inspected in 1980-81 fiscal year. The programs's objectives, developed by a steering committee (California Conference of Directors of Environmental Health, State Department of Health Services, and California Conference of Local Health Officers) are to inventory and inspect small water systems, obtain corrections of deficiencies, and develop an effective evaluation system to measure the program's success. Funds are provided by an EPA grant for small water systems surveillance. The state staff members provide training for local staff members through workshops and personal contact during inspections. (Cassar-FRC)
W83-01911

MANAGEMENT'S ROLE IN CRIME PREVENTION,
Wackenhut Corp., Ponce de Leon, FL.
L. R. Riccio.
Journal of the American Water Works Association, Vol 74, No 10, p506-507, October, 1982.

Descriptors: *Water treatment facilities, *Management planning, *Security, Safety, Water managment, Fences, Utilties.

The Foreign Corrupt Practices Act requires chief officers of any company in the United States to take reasonable action to protect the company's assets. In water treatment facilities the burden of security against crime is often placed upon the plant manager. Professional security consultants have learned that there is no single solution to security for different establishments. Security consultants must know of the threat of crime in a specific water utility is external, internal, or both. Crime in a water utility would probably arise as vandalism and terrorism (external) or theft (internal). Loss of property would focus on physical security such as alarm systems, security guards, or barriers and preventing pilfering by keeping tools under lock and key or posting undercover agents amongst employees. Loss prevention surveys may be conducted by an experienced professional in the security field to pinpoint possible problem areas and suggest what improvments may be made. (Geiger-FRC)
W83-01912

WATER DISTRIBUTION SYSTEMS: A SPATIAL AND COST EVALUATION,
Municipal Environmental Research Lab., Cincinnati, OH.
R. M. Clark, C. L. Stafford, and J. A. Goodrich.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 108, No WR3, p 243-256, October, 1982. 6 Fig, 3 Tab, 12 Ref.

Descriptors: *Water mains, *Repairs, *Economic analysis, Water distribution, Land use, Land development, Cost analysis, Maintenance costs, Pipes, Rehabilitation, Water quality, Corrosion.

Problems in maintaining and replacing water supply distribution systems are associated with public health, economic and spatial development of the community, and costs of repair and replacement of system components. Using data from two utilities (a large facility pumping 150 mgd average through a 3900 mi distribution system and a small rural utility pumping an average of 18 mgd through a 360 mi distribution system) several statistical models and graphical displays were developed to relate water supply infrastructure development with population distribution and growth. A repair frequency analysis showed that over a 40 year period, 52.5% of pipes studied had no maintenance events, 48% had one, and 30% had 2. A minority of pipes were responsible for the majority of repairs. A life expectancy curve (years remaining without a maintenance event) ranged from an additional 11.2 years for an unbroken 5-year old main to 1 year for an unbroken 40 year old main. As the number of maintenance events in a given pipe increased, the time between failures decreased sharply. Curves plotting the annual cost of a system against repair costs indicate an optimal replacement date 30 years after installation. Factors were also developed to account for water corrosivity, agressive water producing 31% higher unit repair costs than harder water. Several other conclusions were reached. The first repairs in metallic pipes occur an average of 13 years later than in reinforced concrete pipes. However, metallic pipes require more repairs than do concrete pipes over the long term. Larger diameter pipes have a longer period before the first repair than smaller diameter pipes. A large percentage of industrial development in the area decreases the time until the first break. Increased development increases repeat breaks. (Cassar-FRC)
W83-01936

ECONOMIC ANALYSIS OF REHABILITATION OF WATER MAINS,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 6B.
W83-01937

COST ESTIMATING FOR CONVENTIONAL WATER TREATMENT,

Municipal Environmental Research Lab., Cincinnati, OH.
R. M. Clark.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No EE5, p 819-834, October 1982. 1 Fig, 6 Tab, 7 Ref.

Descriptors: *Estimating, *Cost analysis, *Water treatment, Drinking water, Potable water, Water quality, Equations, Mathematical equations, Water treatment facilities.

Cost equations are presented which can be used for water treatment unit process cost estimating. The need for pre-design estimates is discussed, and the factors affecting the reliability of cost estimates are examined. These factors include availability of basic data, stage of development, definition of scope, time expended on analysis, and experiences of the analyst. Data for these equations were derived from a carefully designed study to establish water supply unit process costs on a consistent and understandable basis. The basis for derivation of these curves is presented. Examples of the application of these equations are developed, bases on a standard layout for a water supply treatment plant and assumed standard values for the input factors for the cost equations. (Baker-FRC)
W83-01940

CHLORINE RESISTANCE PATTERNS OF BACTERIA FROM TWO DRINKING WATER DISTRIBUTION SYSTEMS,
California Univ., Irvine.
H. F. Ridgway, and B. H. Olson.
Applied and Environmental Microbiology, Vol 44, No 4, p 972-987, October, 1982. 13 Fig, 4 Tab, 36 Ref.

Descriptors: *Chlorine, *Chlorination, *Microorganisms, *Bacteria, *Resistance, *Sensitivity analysis, Drinking water, Biologicl filters, Water treatment, Disinfection, Suspended solids, Potable water, Actinomyces, Water analysis.

The relative chlorine sensitivities of bacteria isolated from chlorinated and unchlorinated drinking water distribution systems were compared by two different methods. In one method, the toxic effect of free chlorine on bacteria was measured, while in the other method,the effect of combined chlorine was recorded. Bacteria from the chlorinated system were more resistant to both forms of chlorine than were those from the unchlorinated system. Bacteria retained on the surfaces of 2.0-micron Nuclepore membrane filters were significantly more resistant to free chlorine than was the total microbial population recovered on 0.2-micron filters, probably because aggregated cells or bacteria attached to suspended particulates exhibit more resistance than unassociated microorganisms. The presence of attached bacteria was confirmed by scanning electron microscopy of suspended particulate matter. The most resistant isolates, which included gram-positive spore-forming bacilli, some micrococci and actinomyces, were able to survive a 20 minute exposure to free chlorine at levels of 10 milligrams/liter. The most sensitive bacteria were readily killed by chlorine concentrations of 1.0 milligrams/liter or less. (Geiger-FRC)
W83-01997

UNDERESTIMATION OF TOTAL-COLIFORM COUNTS BY THE MEMBRANE FILTER VERIFICATION PROCEDURE,
Wisconsin State Lab. of Hygiene, Madison.
J. H. Standridge, and J. J. Delfino.
Applied and Environmental Microbiology, Vol 44, No 4, p 1001-1003, October, 1982. 2 Tab, 13 Ref.

Descriptors: *Microbiological studies, Drinking water, *Coliforms, *Citrobacter, Water quality control, *Culture media, Bacteria, *Membrane filters, Culturing techniques, Testing procedures, Water analysis,, Metabolism.

Quality assurance in microbiology laboratories has become especially important in the analysis of total coliforms in drinking water. Research along these lines has led to the discovery that both the standard most-probable-number technique and the membrane filter technique result in a significant underestimation of coliform numbers in drinking water supplies. Coliforms, primarily Citrobacter freundii, were found to give negative verification results in the total-coliform membrane filtration test due to peptone sources used in the media. The organisms produced gas from lactose in brilliant green bile broth but not in lauryl tryptose broth. Since nitrogen-containing nutrients in the medium can affect the metabolic pathway chosen by the coliforms, the use of a different medium is suggested to solve the problem. (Geiger-FRC)
W83-01998

A BRIEF REVIEW OF THE CURRENT STATUS OF ALTERNATIVES TO CHLORINE DISINFECTION OF WATER,
Tulane Univ., New Orleans, LA. School of Public Health and Tropical Medicine.
A. C. Anderson, R. S. Reimers, and P. deKernion.
American Journal of Public Health, Vol 72, No 11, p 1290-1293, November, 1982. 1 Tab, 32 Ref.

Descriptors: *Disinfection, *Chlorine, *Bromine, *Ozonation, *Water treatment, *Ultraviolet radiation, *Ultrasonics, *Reviews, *Comparison studies, Chlorination, Wastewater treatment, Electromagnetic waves, Drinking water.

Alternative methods to chlorination for the disinfection of drinking water and wastewater are reviewed. Chlorine dioxide is a stronger oxidant than chlorine and effectively destroys coliforms, enteroviruses, and pathogenic amebas. It does not react with ammonia or aromatic organics and does not produce trihalomethanes. The disadvantages of chlorine dioxide include its cost and production problems. Ozone does not form trihalomethanes in water, and can also remove trihalomethane precursors. The lack of information on the organic reaction products of ozone is a cause for concern about its use as a disinfectant. Since ozone does not form a residual, it must be used in conjunction with another disinfectant to protect the distribution system. Bromine chloride is more reactive than chlorine for inactivating enteric viruses and coliforms in wastewater. More testing is needed on human and aquatic toxic effects before bromine chloride can be fully used as an alternative disinfectant. Recent advances in equipment design are making disinfection by ultraviolet (UV) light more feasible. Intense doses of UV are required to inactivate bacterial and fungal spores and protozoa. UV produces no chemical by-products or toxic residues, but must be used with another disinfectant to maintain disinfection throughout the distribution system. Ultrasound is relatively expensive and can be rendered ineffective by thick films of water. Recent research has confirmed the ability of electrostatic processes to reduce bacteria and viruses along with boiler scale and corrosion. (Geiger-FRC)
W83-02016

THE NEED FOR PREVENTIVE CONTROL OF DRINKING WATER CONTAMINANTS,
Princeton Univ., NJ. Center for Energy and Environmental Studies.
For primary bibliographic entry see Field 5G.
W83-02031

ALTERNATIVE DISINFECTION METHODS - A COMPARISON OF UV AND OZONE,
Photox International, Inc., Houston, TX.
R. W. Legan.
Industrial Water Engineering, Vol 19, No 2, p 12-25, March/April, 1982. 7 Fig, 8 Tab, 6 Ref.

Descriptors: *Disinfection, *Chlorination, *Ozone, *Ultraviolet light, Photoreactivation, Drinking water, *Water treatment.

Up-to-date information is presented on disinfection methods, their efficiency and their cost. The discussion focuses primarily on ultraviolet light and ozone as the main disinfection alternatives, as they are the most likely method to ultimately replace chlorine. In spite of various difficulties with chlorination, if a disinfection alternative for a 30/30 effluent stream (30 mg/liter BOD and 30 mg/liter TSS) is to be purchased currently, based only on the criterion that it is proven technology, the chlorination/dechlorination process is the only choice. Since 1965 a number of laboratory and pilot-plant studies have been conducted to evaluate the effectiveness of ozone in disinfecting wastewater, both as an oxidant and as a germicidal compound. Technology in the ultraviolet light field has developed to such a point that it can now be used to efficiently and economically disinfect water streams. Problems of turbidity, short-circuiting, and photoreactivation using ultraviolet light disinfection systems are considered. (Baker-FRC)
W83-02083

CHARACTERIZATION OF INDICATOR BACTERIA IN MUNICIPAL RAW WATER, DRINKING WATER, AND NEW MAIN WATER SAMPLES,
Ontario Ministry of the Environment, Rexdale. Lab. Services Branch.
J. A. Clark, C. A. Burger, and L. E. Sabatinos.
Canadian Journal of Microbiology, Vol 28, No 9, p 1002-1013, September, 1982. 1 Fig, 6 Tab, 10 Ref.

Descriptors: *Pollutant identifcation, *Bacteria, *Bioindicators, *Water pollution sources, *Municipal water, *Water analysis, *Computers, Escherichia coli, Enterobacter, Aeromonas, Klebsiella, Citrobacter, Indicators, Water treatment, Raw water, Drinking water, Membrane filters.

A computerized system was developed for handling data on municipal water samples that were analyzed by membrane filter (MF) and presence-absence (PA) tests for pollution indicator bacteria. Over a four-yr period, 11,514 bacterial cultures were isolated from either raw water, drinking water, or new main water samples analyzed by three laboratories. The species occurring most often in all types of water samples were Escherichia coli, Enterobacter aerogenes, Aeromonas hydrophila, Klebsiella pneumoniae, and Citrobacter freundii. In the presumptive portion of the PA test, a lactose-lauryl tryptose broth was examined as an alternative medium to modified MacConkey broth. The intensity of acid and gas production in presumptive positive PA bottles was compared with the types and frequencies of indicator bacteria demonstrated by confirmatory tests. The results of detecting indicator bacteria after analysis of 53,130 samples over a 2-year period were catagorized by water source and type to determine the effect of these parameters on the recovery of indicator bacteria. Further subdivision of sample types according to source illustrated the effects of water treatment practices on the presence of indicator bacteria. (Geiger-FRC)
W83-02097

5G. Water Quality Control

THE DIVERSION BOX: A PROVEN TECHNOLOGY FOR POLLUTION ABATEMENT,
Altamonte Springs Public Works Dept., FL.
D. F. Newnham, S. M. Gilbertson, and M. G. Crumpton.
Public Works, Vol 113, No 10, p 54-55, October, 1982. 3 Fig.

Descriptors: *Storm water, *Diversion structures, Retention, Ponds, Weirs, Water pollution control.

An inexpensive, easily maintained, and highly effective diversion box diverts the initial flush of polluted storm water to a retention facility for subsequent treatment. The configuration of the pond and the height of the weir are chosen so that the pond will gradually fill and the water in the pond and in the input side of the diversion box will rise to the top of the weir after the first inch of storm water has been received. As additional, cleaner water enters the box, the water level flows over the weir into the outlet side of the structure. The polluted water in the pond cannot return into the diversion box. When the water flow on the inlet side of the box decreases, the flow over the weir box ceases abruptly, and the outlet side of the box is routed to a receiving water body. The

diversion box prevents pollution accumulated in several minor storms from being flushed from the retention pond during a major storm. (Cassar-FRC)
W83-01822

EVALUATION OF FILTER FABRICS FOR USE IN SILT FENCES,
D. C. Wyant.
Transportation Research Record, Vol 832, p 6-12, 1981. 2 Fig, 6 Tab, 8 Ref.

Descriptors: *Road construction, *Highway effects, *Performance evaluation, *Erosion control, *Fabrics, Soil erosion, Erosion, Silt load, Silt, Strength, Filtration, Flow rates.

A study was conducted to develop data to be used in purchasing filter fabrics for building silt fences on highway construction projects. Seven performance tests were carried out on each of fifteen fabrics. Two of the tests - laboratory filtering efficiency and tensile strength - have been adopted by the Virginia Department of Highways and Transportation for choosing filter fabrics to be used on construction projects. These two tests help ascertain filtering efficiency, flow rate, and warp tensile strength. A third test for determining resistance to damage by ultraviolet rays was not recommended to the department for use due to its lack of reproducibility. More work is needed on ways to evaluate this critical parameter. (Geiger-FRC)
W83-01830

CLEANING UP A HAZARDOUS WASTES SITE CATASTROPHE,
O.H. Materials Co., Findlay, OH.
J. T. Vielhaber, and J. R. Van Meter.
Industrial Wastes, Vol 28, No 5, p 16-18, September/October, 1982.

Descriptors: *Hazardous materials, *Accidents, *Cleanup operations, *Waste management, Water analysis, Chemical analysis, Explosions, Environmental effects, Cleanup, Decontamination, Fate of pollutants.

Hazardous waste cleanup operations were required following a disastrous fire at the Chemical Control Corporation, a hazardous wastes treatment and disposal facility located in Elizabeth, New Jersey. The fire resulted from an explosion of 60,000 barrels of toxic wastes and chemicals. Based on preliminary testing of air, soil and water, three zones of contamination were established. Much of the storage that had been performed at the company had been alleged to be illegal, and there was no documentation to indicate the materials stored. Most labels were destroyed in the fire. A barrel grappler was designed and fabricated, modeled after the grapplers used by loggers in the northwest. Rapid turn-around time for analysis was essential for proper identification of contaminants. Sophisticated laboratory equipment including GC/MS and atomic absorption units provided for thorough analysis of over 30,000 samples at minimum expense. Thus the emergency was dealt with through remote, safe and efficient drum handling techniques, aggregate bulking of compatible waste, on-site mobile laboratory services, and the recovery and on-site treatment of contaminated groundwater. (Baker-FRC)
W83-01837

WHO IS KILLING THE RHINE,
M. J. Kurlansky.
Environment, Vol 24, No 7, p 41-42, September, 1982.

Descriptors: *Drinking water, *Water pollution control, *Industrial wastes, Water pollution sources, *Rhine River, Regulations, Water management, Salt, Arsenic, Heavy metals, Radioactive wastes, Legislation, *Netherlands.

The Rhine River provides the source of 80% of the Dutch drinking water, feeds the soil for agriculture, flushes the sea water out of the coastal lands and canals, provides transportation through a network of tributaries and canals, and is a food source for man and wildlife. Through negligence the water supply is being damaged by the Swiss, West Germans, French and the Dutch themselves, as it is being contaminated with salt, arsenic, mercury, cadmium, chromium, DDT, PCBs, radioactive tritium, petroleum, copper, zinc, lead, and other substances of industrial origin. An accord on chemical pollution was ratified by the Rhine countries in 1979. The agreement was made to fix maximum allowable discharge levels for each substance. To date the only substance these countries have acted on is mercury, a highly toxic heavy metal that has shown signs of a reduced presence in the river. The Rheinwater Foundation and ten other Dutch organizations are establishing an International Water Tribunal which will convene in April 1983 to review and lobby for the redress of individual cases of pollution in the Rhine-North Sea water system. (Baker-FRC)
W83-01838

CLOSED CYCLE INDUSTRIAL WASTES CONTROL,
Agricultural Research Service, Kimberly, ID. Snake River Conservation Research Center.
J. H. Smith, and J. H. Oates.
Industrial Wastes, Vol 28, No 4, p 30-31, July/August. 1982 1 Fig, 2 Tab.

Descriptors: *Wastewater irrigation, *Irrigation water, *Food-processing wastes, Potatoes, Land reclamation, Caldwell, *Idaho, Livestock, Manure, Animal wastes, Forages, Wastewater treatment, Nitrites, Industrial wastes.

All the 4.5 mgd of wastewater from the J. R. Simplot Company potato processing plant and livestock feeding operation in Caldwell, Idaho, is applied to nearby grass and corn fields. No wastewater has been discharged into the adjacent Boise River since 1972. Application, although still somewhat uneven with respect to volume and nutrients, averages 48 inches per year over the 800 acres. During passage through the soil, removal of COD and plant nutrients is essentially 100%. Groundwater quality is good. Nitrates average 0.3 mg per liter, a result of rapid denitrification in the shallow water table. One effect of this disposal process has been to reclaim the land by leaching saline solids from the formerly saline fields. Average yield of grass is 18-20 tons per acre. (Cassar-FRC)
W83-01843

CLOSING THE CIRCLE ON WASTEWATER TREATMENT.
Industrial Wastes, Vol 28, No 4, p 21-22, July/August, 1982. 4 Tab.

Descriptors: *Information exchange, *Industrial wastes, *Waste management, Wastewater treatment, Waste treatment, Midwest Industrial Waste Exchange, Waste disposal.

The Midwest Industrial Waste Exchange, St. Louis, Missouri, started in 1975, serves as an information exchange and matchmaker for industrial waste generators and users. For example, waste from one industry may be used as a raw material in another process, or 2 wastes (acid and base) may be used for mutual treatment. A catalog published every 3 months (with supplements) lists available and desired wastes. The May 15, 1982, catalog had 86 available listings, 20 wanted listings, and 5348 subscribers. Inquiries average 56 a month. Successful exchanges from June 1980 to September 1981 totaled 21, with 70 transactions in the negotiation stage. (Cassar-FRC)
W83-01845

STATUS REPORT ON ABATEMENT OF WATER POLLUTION FROM THE CANADIAN PULP AND PAPER INDUSTRY (1980).
Environmental Protection Service, Ottawa (Ontario). Water Pollution Control Directorate.
Economic and Technical Review Report EPS 3-WP-82-3, July 1982, 26 p, 2 Fig, 10 Tab, (also in French).

Descriptors: *Pulp and paper industry, *Water pollution control, *Industrial wastewater, *Canada, Biochemical oxygen demand, Suspended solids, Process control, Toxicity, Costs, Sulfite mills.

Regulations to limit the discharge of pollutants in liquid effluents from the Canadian pulp and paper industry were promulgated by the federal government in 1971. Between 1978 an 1980, pulp and paper production increased about 1.5%. Total suspended solids (TSS) discharged were reduced by about 6%, and BOD was reduced by about 3%. Reductions in TSS on a per tonne basis were noted for all regions except the Northwest region, where discharges remained stable, and in Quebec region where TSS per tonne increased slightly. On a per tonne basis, BOD5 discharges were lower in all regions except Quebec. Many mills do not yet have compliance schedules for reductions in the toxicity of effluents to fish. Some mills have been successfully using internal measures with-out bio-treatment to reduce toxicity. Between 1969 and 1980, inclusive, the expenditures on abatement facilities have amounted to about $661,000,000. Process changes, such as the use of thermo-mechanical pulp, have been suggested as one of the possible solutions to difficulties in the abatement program for the newsprint sulfite sector of the industry. The Environmental Protection Service continues to encourage the submission of compliance programs in which in-plant controls are to be implemented. This approach fosters the principle of prevention rather than treatment. Reduction of the total pollutant discharge is important because many pollutants are refractory to biological treatment. (Moore-SRC)
W83-01886

COST-EFFECTIVE PRETREATMENT PROGRAMS,
Environmental Protection Agency, Cincinnati, OH.
L. A. Rossman.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No EE4, p 665-679, August, 1982. 2 Fig, 4 Tab, 12 Ref.

Descriptors: *Industrial wastewater, *Cost-benefit analysis, *Pretreatment of wastewater, Municipal wastewater, Wastewater treatment, Cost allocation, Model studies, Water quality control, Sludge, Kokomo, *Indiana, Heavy metals, Metals, Economic aspects, Effluent limitations.

A method is developed for planning cost-effective integrated industrial-municipal pretreatment programs for toxic pollutants. It uses mathematical programming to determine the levels of industrial pretreatment and municipal treatment which will meet the relevant environmental standards (sewer discharges, receiving water quality, and sludge quality) at minimum total cost. The problem is formulated as a nonlinear 0-1 integer program model. An implicit enumeration procedure that exploits the special structure of the problem is used for the solution. An analysis of heavy metals in the Kokomo, Indiana, treatment system showed that using uniform national standards for pretreatment was less cost-effective than using no minimum standards. Industrial sources accounted for 28% of total flow and 67-99% of Cd, Cr, Cu, Ni, and Zn entering the municipal plant. Cu was the critical receiving water parameter. If all Cu from the industrial sources were eliminated, other contributing sources would cause violation of the EPA limit 36% of the time using secondary municipal treatment and 22% of the time using tertiary municipal treatment. This method allows a city's pretreatment requirements to be matched to local conditions. Using the desired receiving water quality as a goal, the treatment is distributed among the individual industries and the municipal plants on a cost-effective basis. In general, the industry with the largest pollutant input is required to treat to a higher level. The problem of differences in treatment levels may cause complaints of inequity, which must be resolved. (Cassar-FRC)
W83-01903

MODELING AND INTERPRETING OXYGEN TRANSFER DATA,

Tufts Univ., Medford, MA. Dept. of Civil Engineering.
L. C. Brown, and C. R. Baillod.
Journal of the Environmental Engineering Division, Prodeedings of the American Society of Civil Engineers, Vol 108, No EE4, p 607-628, August 1982. 2 Fig, 2 Tab, 23 Ref.

Descriptors: *Oxygen transfer, *Aeration, Wastewater treatmet, Kinetics, Model studies, Design criteria, Mixing, Mass transfer, Dissolved oxygen.

Recommendations for modeling, parameter estimation, and experimental design in unsteady state clean water aeration tests are given. The best model for analysis of both surface and subsurface oxygen transfer test data is the exponential form of the first order mass transfer equation. It fits most of the observed data, but overestimates the average driving force during the unsteady state test. The model, which applies to a given aeration system in a given tank under steady-state hydraulic conditions, can be viewed either as based on a completely mixed system with uniform dissolved oxygen values in which oxygen is transferred throughout the tank volume or as based on a compartmentalized system in which oxygen transfer is confined to a localized aeration zone. A nonlinear least squares regression procedure is recommended for estimating the oxygen transfer coefficient and equilibrium saturation concentration. The Best Fit Log Deficit Method is an acceptable alternate procedure usable when a computer is unavailable. Techniques for selecting the number and spacing of data values and for assessing model adequacy are suggested. A sample problem illustrates the given procedure for applying clean water test results to field water conditions. (Cassar-FRC)
W83-01938

LAKE PHYTOPLANKTON MODEL WITH DESTRATIFICATION,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
J. S. Gulliver, and H. G. Stefan.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No EE5, p 864-882, October, 1982. 12 Fig, 1 Tab, 28 Ref.

Descriptors: *Lake management, *Phytoplankton, *Phosphorus, Nutrients, Phosphates, Seasonal variation, Sediments, Chlorophyll, Model studies, Lake Calhoun, Destratification, Eutrophication, *Minnesota.

The phytoplankton mass and available phosphorus during a destratification experiment conducted at Lake Calhoun, Minnesota, in 1972 are simulated by a numerical, multilayered, unsteady numerical model. A time scale of one day is used. The effects of surface mixed layer dynamics, phosphate-phosphorus inflows from surface runoff, recycling of phosphate-phosphorus from the sediments, available light, temperature, and mixing in the hypolimnion on phytoplankton productivity are analyzed. The model was used to hindcast the events of 1972 and to explore the effects of lake management alternatives such as the reduction of phosphate-phosphorus runoff, the elimination of phosphorus recycling, and the maintenance of an artificially deepened surface layer. According to model results the phosphate-phosphorus released by sediments did not influence surface layer phytoplankton populations except during the destratification experiment and during fall turnover. In both cases the strongly stratified, metalimnion-resisting vertical transport was destroyed. High phosphate-phosphorus concentrations in the spring are in part attributable to internal loading from the previous summer. (Baker-FRC)
W83-01939

STORMWATER POLLUTION CONTROL: BEST MANAGEMENT PRACTICES,
Santa Clara Univ., CA. Dept. of Civil Engineering.
E. J. Finnemore.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 108, No EE5, p 835-851, October, 1982. 1 Fig, 2 Tab, 24 Ref.

Descriptors: *Water pollution control, *Storm runoff, Storm wastewater, Water pollution sources, Street cleaning, Heavy metals, Suspended solids, Sediment transport, Erosion, Erosion control, California, Cost analysis, Maryland, Urban runoff, Management, Washington.

Case studies are presented which describe four instances in which successful and very promising best management practices (BMPs) were employed for nonstructural and elementary structural stormwater pollution control. Their approaches, implementation, and resulting performance, costs and impacts are described for the use of planners and designers. In Bellevue, Washington, an innovative stormwater utility has effectively administered Bellevue's stormwater management program. In a regional approach at Montgomery County, Maryland, many source controls have minimized erosion and removed most pollution from urban runoff at moderate costs. Near Lake Tahoe, in California, planning for stormwater management aided by erosion controls has prevented tremendous increases in sediment yields. At San Jose, California, extensive studies revealed that improved street cleaning will effectively control total solids and heavy metals in runoff. (Baker-FRC)
W83-01941

DECARBONATION OF LIMESTONE-TREATED MINE DRAINAGE,
California Univ., Richmond. Sanitary Engineering and Environmental Health Research Lab.
F. Pearson, S. McBride, and N. Batcheler.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No EE5, p 957-972, October, 1982. 11 Fig, 1 Tab, 10 Ref.

Descriptors: *Mine drainage, *Decarbonation, *Water pollution control, Limestone, Drainage, Acidity, Percolation, Leaching, *Pennsylvania, Hazelton.

Crushed limestone is used in various processes to neutralize acid mine drainage in a 2.5 mgd facility near Hazelton, Pennsylvania. A 0.5 mgd stream was treated by two limestone packed tumbling drums in series to increase pH from 3.7 to 5.4 followed by a lagoon for carbon dioxide removal that further increased pH to 6.1, to meet the pH 6 effluent quality target. Decarbonation process theory and design procedures are proposed. Graphs show pH increase versus carbon dioxide removal and carbon dioxide removal versus time of treatment as well as the overall film transfer coefficient. Nomographs also show how carbon dioxide removal depends on air-to-water ratio, air-water contact time, bubble or droplet diameter, and the turbulence-dependent film transfer coefficient. Use of nomographs is illustrated by calculation of the film transfer coefficient from experimental data. (Baker-FRC)
W83-01942

STORMWATER POLLUTION CONTROL: STRUCTURAL MEASURES,
Santa Clara Univ., CA. Dept. of Civil Engineering.
E. J. Finnemore.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No EE4, p 706-721, August, 1982. 6 Fig, 3 Tab, 11 Ref.

Descriptors: *Storm wastewater, *Combined sewer overflows, *Sewer systems, Water quality control, Overflows, Water pollution control, Seattle, Washington, Saginaw, Michigan, Mount Clemens, Wastewater treatment, Storm sewers, Cost-benefit analysis, Water storage, Control systems.

A review of information on costs, feasibilities and efficiences of combined sewer overflow (CSO) control measures reveals that no one method can handle all CSO problems. The most important feature of cost-effective structural control measures is storage. It attenuates peak flows, reduces overflows, and contains pollutants. Integration between storage and treatment is particularly effective because it can use the existing collection system, can use the most cost-effective combination of storage and treatment, and can integrate CSO controls with other facilities and projects to achieve higher levels of pollution control. Three case studies of CSO control programs are described. Seattle, Washington, uses computerilized in-line storage in existing sewer interceptors and trunk sewers. Saginaw, Michigan, integrates off-line storage/treatment with in-line storage and dry weather treatment to attain high performance at moderate costs. At Mount Clemens, Michigan, the control program includes partial sewer separation, interception of overflows, and combined sewer storage and treatment facilities associated with a multiuse park and lake system for final polishing. Selecting an appropriate CSO control for a given site should consider reduction of total overflow volume, reduction of frequency of overflow events, and reduction of pollutant loadings to receiving waters. Tables comparing cost and performance for the three systems are given as a planning aid. Selection should also consider size, complexity, and ways to combine components and integrate them with other facilities. (Cassar-FRC)
W83-01944

WATER QUALITY INVENTORY AND MONITORING PROGRAM FOR THE COMMONWEALTH OF VIRGINIA: STATE-OF-THE-ART,
Virginia Univ., Charlottesville. Dept. of Civil Engineering.
For primary bibliographic entry see Field 10C.
W83-01949

UNCERTAINTY ANALYSIS OF DISSOLVED OXYGEN MODEL,
Villanova Univ., PA. Dept. of Civil Engineering.
R. A. Chadderton, A. C. Miller, and A. J. McDonnell.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No EE5, p 1003-1013, October, 1982. 7 Tab, 14 Ref.

Descriptors: *Dissolved oxygen, *Model studies, *Uncertainty analysis, Prediction, Estimating, *Streeter-Phelps equation, Mathematical equations, Mathematical studies, Streams, *Deoxygenation, Oxygen, Water quality, *Reaeration.

First-order uncertainty analysis was applied to 258 stream segments to determine the relative contributions to scatter or uncertainty in dissolved oxygen predictions by each of the parameters of the Streeter-Phelps equation. For very sluggish streams with reaeration rates less than about 0.1 per day, the most important parameters for dissolved oxygen predictions were the initial deficit and the deoxygenation rate constant. For streams having reaeration coefficients greater than 0.1 per day the most important parameter corresponded to the predominant aspect of the oxygen balancing mechanism for the stream segment. On the depletion portion of the dissolved oxygen sag curve, where deoxygenation exceeds reaeration, the deoxygenation rate constant contributed most of the uncertainty in dissolved oxygen prediction. However, on the recovery portion of the dissolved oxygen sag curve, where reaeration exceeded deoxygenation, the reaeration rate constant contributed most of the uncertainty in dissolved oxygen predictions. Application of the uncertainty analysis to identify critical water quality parameters for a given stream would lead to more efficient data collection efforts. (Baker-FRC)
W83-01961

NEW CHALLENGES IN THE GREAT LAKE STATES TO BANNING PHOSPHORUS IN DETERGENTS,
K. C. Flynn.
Journal of the Water Pollution Control Federation, Vol 54, No 10, p 1342-1345, October, 1982. 1 Fig, 1 Tab.

Descriptors: *Detergents, *Phosphates, *Water pollution control, Legislation, Bans, Regulations, State jurisdiction, Legal aspects, *Great Lakes region, Canada, Wisconsin, Michigan, Indiana, Minnesota, New York, Chicago.

Since the early 1970's, attempts to control the amount of phosphorus reaching the Great Lakes have been a matter of grave concern to states in the northern United States and to Canadian provinces in the Great Lakes Basin area. One of the most effective steps taken to ensure such control was the passing of bans against the use of detergents containing phosphates. Recently this effective measure was apparently weakened in Wisconsin, where a 3-year ban was allowed to expire without being renewed. Arguments are presented on both sides of the issues. One side claims that improved wastewater treatment now makes such bans unnecessary. The other side claims that lifting bans now would be somewhat premature. With phosphorus detergent bans or limitations still in effect in Canada, Indiana, Minnesota, Michigan, New York and Chicago, there is no immediate concern that the Wisconsin decision will cause a domino effect, with a rush to lift all the bans. However, it is expected that the next time this issue comes before a state legislature there is bound to be more debate than occurred in Wisconsin. (Baker-FRC)
W83-01967

NPDES RULES FOR INDUSTRIAL DISCHARGERS: NEW OBLIGATIONS, NEW OPPORTUNITIES,
Smith and Schnacke, Dayton, OH.
R. S. Frye.
Journal of the Water Pollution Control Federation, Vol 54, No 10, p 1349-1354, October, 1982. 7 Ref.

Descriptors: *Regulation, *Industrial wastes, Industrial discharges, Effluents, Water quality, Water pollution control, Legislation, Legal aspects, NPDES.

The most important aspects of the existing regulations regarding industrial dischargers are reviewed, expected changes are summarized, and some strategies are suggested for obtaining the most reasonable permit conditions within this regulatory scheme. It is concluded that in order to obtain the best result and highest cost savings from the NPDES permitting process, it is necessary to be closely acquainted with the applicable rules and with anticipated changes. Preparation must be made well ahead of time for any permit, permit renewal, or permit modification. One should be aware of deadlines for applications, requests for modifications, and variance requests. State requirements may be different from federal requirements. Case-by-case effluent limitations that will remain in effect even if less stringent national effluent limitations guidelines are subsequently published should be avoided. The form in which effluent limitations are expressed and the associated compliance monitoring requirements can be as important as the technological basis for those limitations. If the discharge is water-quality limited, one must keep track of and participate in the state's water quality management planning for the receiving stream. (Baker-FRC)
W83-01968

RELATION OF INFLOW/INFILTRATION COSTS TO VARYING POLICY REQUIREMENTS,
National Semiconductor Corp., Santa Clara, CA.
D. I. Wilkowsky, C. T. Way, D. L. Tucker, and D. S. Parker.
Journal of the Water Pollution Control Federation, Vol 54, No 10, p 1361-1375, October, 1982. 11 Fig, 6 Tab, 2 Ref.

Descriptors: *Inflow, *Infiltration, *Cost analysis, Requirements, Regulations, Hydraulic profiles, Water quality, Permits, Wastewater treatment.

The costs of managing wet weather induced inflow and infiltration with the policy requirements of the federal and state water quality agencies are contrasted. The presentation describes the framework in which the study was conducted, illustrates the techniques used for coordinating the study with regulatory agencies during the conduct of the study, and presents the costs of alternative levels of improvements. Many of the permit conditions tested increased overall treatment costs without substantial increases in water quality. With the exception of two no-project alternatives and one satellite treatment alternative with treatment facilities remote from the Water Pollution Control Plant (WPCP), the alternative control plans centered around various schemes for storing the diluted wastewater until the storm passed, and then on diminution of the storm event, returning the stored wastewater for subsequent treatment at the WPCP. This project involved consideration of varying levels of pollution control. The alternative selected provided three storage locations. The connections from the collection agencies' system to the district interceptors currently provide a hydraulic bottleneck for wet-weather flows. Upstream overflows of collection systems would continue until corrected by the ongoing efforts of the collection agencies. This alternative gave the greatest reduction of existing overflows for the least cost. (Baker-FRC)
W83-01969

ENVIRONMENTAL EFFECTS OF A MEDIUM-FERTILITY 12-MONTH PASTURE PROGRAM: I. HYDROLOGY AND SOIL LOSS,
Agricultural Research Service, Coshocton, OH. North Appalachian Experimental Watershed.
L. B. Owens, R. W. Van Keuren, and W.M. Edwards.
Journal of Environmental Quality, Vol 11, No 2, p 236-240, April-June, 1982. 1 Fig, 6 Tab, 11 Ref.

Descriptors: *Surface runoff, *Pasture management, *Soil erosion, Hydrologic budget, Cattle, Runoff volume, Agricultural runoff, Grazing, Erosion control, Watershed studies, Soil conservation, Watershed protection.

The hydrologic and soil erosion changes resulting from two beef cattle pasturing programs were investigated in four small, sloping upland watersheds in Ohio over a 5-year period. The cattle grazed all four pastures rotationally between May and October each year. One plot was also used for wintering the cattle on hay all five winters. The pastures, which had previously been in meadow and light pasturing, had long-term average surface runoffs of about 15 millimeters per year. A slight increase in surface runoff and a trace of soil loss was found in the three pastures with summer grazing only over the 5 years of the study. However, the pasture which was used for both summer grazing and winter feeding showed a large increase in surface runoff, which averaged about 130 millimeters per year during the study. Soil loss also increased sharply to 1,355 kilograms per hectare per year, with 81% of this loss occurring during the dormant season. Although large runoff events were only a small percentage of the total number of events, they produced most of the runoff volume and most of the soil loss. Water balance studies indicated that the subsurface flow was relatively unchanged by the grazing program. The increase in surface runoff was offset by a decrease in evapotranspiration. (Carroll-FRC)
W83-01973

ENVIRONMENTAL EFFECTS OF A MEDIUM-FERTILITY 12-MONTH PASTURE PROGRAM: II. NITROGEN,
Agricultural Research Service, Coshocton, OH. North Appalachian Experimental Watershed.
L. B. Owens, R. W. Van Keuren, and W. M. Edwards.
Journal of Environmental Quality, Vol 11, No 2, p 241-246, April-June, 1982. 3 Fig, 6 Tab, 21 Ref.

Descriptors: *Nitrogen, *Pasture management, *Agricultural runoff, Cattle, Grazing, Surface runoff, Soil erosion, Groundwater runoff, Water pollution, Nitrates, Path of pollutants, *Ohio, Nonpoint pollution sources.

The effects of two beef cattle pasturing programs on nitrogen levels in water were investigated in four small, sloping upland watersheds in Ohio over a 5-year period. The cattle grazed all four pastures rotationally between May and October. One plot was also used for wintering the cattle on hay all five winters. Nitrate-nitrogen and ammonium-nitrogen concentrations were determined for precipitation, surface runoff, subsurface flow, and sediment. The nitrate-nitrogen level was generally higher in the surface runoff from the winter feeding plot than from the summer-grazing-only plots, but rarely resulted in any significant impairment of water quality. The nitrogen transported in the subsurface flow from the summer grazing only pastures was about equal to that transported from the wintering plot and to the amount of nitrogen received in the precipitation. The increased surface runoff and soil erosion resulting from the reduction of vegetative cover and increased soil disturbance on the pasture used for wintering cattle resulted in the transport of much greater quantities of nitrogen in surface runoff and sediment from this plot as compared to the summer grazing only plots. The pastures used only for summer grazing experienced very little surface runoff and only a trace of soil loss. Surface and subsurface losses of nitrogen from the winter feeding area were nearly equal. Although large storms represented only a small percentage of the total number of events, they transported a large proportion of the nitrogen. (Carroll-FRC)
W83-01974

ANALYZING TRANSPORTATION-RELATED HAZARDOUS MATERIAL SPILLS IN NEW ENGLAND,
Worcester Polytechnic Inst., MA.
T. C. Crusberg, and D. L. Smith.
Journal of the American Water Works Association, Vol 74, No 10, p 499-505, October, 1982. 4 Fig, 5 Tab, 14 Ref.

Descriptors: *Federal jurisdiction, *Water pollution prevention, Water pollution control, *Hazardous materials, *Transportation, *Accidents, *New England, Drinking water, Toxins, Poisons, Surface water, *Regulations, Legal aspects.

Transportation-related hazardous material spills present a substantial threat to surface water supplies in New England. A statistical analysis of reports made to the United States Environmental Protection Agency in Region I (Lexington, Massachusetts) shows that informing the federal government of such spills is subject to considerable underreporting. To enact legislation to deal with hazardous spills and protect watersheds, the federal government requires more accurate information regarding the severity and incidence of hazardous material spills due to transportation accidents. From 1978 to 1981, the number of transportation-related spills entering surface water in New England was 178. Of these, very few were reported to the federal government. The regulations now being promulgated under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (PL 96-510) should provide the necessary legal framework to enforce a universal reporting program for spills of all hazardous materials. (Geiger-FRC)
W83-02028

THE NEED FOR PREVENTIVE CONTROL OF DRINKING WATER CONTAMINANTS,
Princeton Univ., NJ. Center for Energy and Environmental Studies.
G. L. Singer.
Journal of the American Water Works Association, Vol 74, No 10, p 18, 49, October, 1982.

Descriptors: *Water quality control, *Water pollution prevention, *Monitoring, *Water quality standards, *Public health, *Drinking water, *Cost-benefit analysis, Water treatment, Water quality management, Safety, Groundwater management, Water law.

The testimony of Grace L. Singer before the United States Senate subcommittee concerning toxic substances and environmental oversight relating to the Safe Drinking Water Act of May 26, 1982, is presented in abridged form. Only 16 chemicals are regulated under the Safe Drinking Water Act. Compared to European nations, the United States conducts very infrequent monitoring for toxic chemicals in surface or groundwater supplies. In some European water treatment plants, continuous monitoring tests using trout are performed to assess the quality of incoming raw

water. While groundwater protection measures are moving forward in Europe, in the United States they have been stalled since 1980 due to proposed amendments which will weaken both the Safe Drinking Water Act and the Clean Water Act. Within the limits of cost considerations, the EPA must regulate the contaminants which have any adverse effects on public health. In Europe, where water treatment can include steps involving granular activated carbon and ozonation for disinfection, the treatment cost may be only 10-20% of the cost of delivered water, with the remainder covering distribution, administration, etc. Based on EPA estimates for New Jersey, costs of water treatment ranged from $16 to $27 annually per household for a 5 to 66-mgd treatment plant. A cost criterion based on a per capita or per household unit seems to be a logical way of computing a cost-benefit analysis. A groundwater protection strategy should be a major goal of watershed protection rather than counting on expensive eater treatment later. (Geiger-FRC)
W83-02031

GROUNDWATER QUALITY MANAGEMENT,
Oklahoma Univ., Norman.
L. W. Canter.
Journal of the American Water Works Association, Vol 74, No 10, p 521-527, October, 1982. 6 Tab, 3 Ref.

Descriptors: *Groundwater management, *Water resources development, *Water quality management, *Case studies, *Project planning, *Aquifer management, Oklahoma, Groundwater potential, Aquifers, Water supply development, Protection, Future planning.

A case study related to developing a groundwater quality management plan is reviewed, and some options relative to the development of a national groundwater protection strategy and the research programs of the National Center for Ground Water Research (NCGWR) are described. A comprehensive four year study program was submitted by the Association of Central Oklahoma Governments (ACOG) to Congress to gather information for the continued use and development of the Garber-Wellington (G-W) aquifer that serves central Oklahoma. A preliminary study was conducted by the University of Oklahoma to collect existing data on the G-W aquifer and plan how to divide work tasks for the more expensive long term study. A computer-based literature survey of the preliminary study provided data on groundwater quality management. Nine data gaps were defined and given priority as subjects for tasks in the four-year study. Budget allocations were based on weighted rankings. The potential components of a national groundwater protection strategy are defined. The primary focus of the NCGWR is anticipatory research to identify long-term problems and needs specifically in the areas of transport and fate of pollutants, subsurface characterization, and development of equipment and technology for drilling and coring. (Geiger-FRC)
W83-02032

PROTECTING DRINKING WATER SUPPLIES THROUGH WATERSHED MANAGEMENT. A GUIDEBOOK FOR DEVISING LOCAL PROGRAMS,
North Carolina Univ. at Chapel Hill. Center for Urban and Regional Studies.
R. J. Burby, E. J. Kaiser, T. L. Miller, and D. H. Moreau.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-167858, Price codes: A14 in paper copy, A01 in microfiche. Report, August 1982. 323 p, 7 Fig, 31 Tab, 193 Ref, 1 Append. OWRT C-00047-U(0509)(1).

Descriptors: *Watershed management, *Water pollution control, *Land use, *Urban areas, *Drinking water, Land acquistion, Regulations, Taxes, Water pollution sources, Policy, Legal aspects.

In the past, protection of water supply sources relied on the concept of source isolation through purchase of the surrounding area. This practice is no longer practical, particularly in aeas where urban development pressures are accelerating. As a result, water supply systems and local governments must devise watershed strategies which incorporate a variety of measures and institutional arrangements to protect raw water supplies from contamination. Careful investigation of existing and potential land use activities in the watershed, and their potential for pollution, is one of the best means of assessing the risks development poses for drinking water. Once threats to water supplies have been determined, there are a variety of methods that may be used to manage watesheds. Land use planning measures are designed to reduce the susceptibility to harm from pollution by affecting the type and location of human activities occurring in the watershed. Regulations, capital improvements, land acquisition, and preferential taxation can be used to guide urban growth. A second critical aspect of watershed management programs is control over the characteristics of site development allowed in the watershed so as to minimize the generation and transport of various pollutants. Before any given combination of land use and site-level measures is adopted, it should be evaluated in terms of policy framework which sets overall agency goals, hoped for equity, efficiency, and feasibility characteristics of the management program, and principles and standards for developmnet and use of the watershed. Finally, it is important to continuously reassess management efforts to ensure that they are having their intended effects. (Moore-SRC)
W83-02055

EFFECTS OF RELEASES OF SEDIMENT FROM RESERVOIRS ON STREAM BIOTA,
Colorado State Univ., Fort Collins. Dept. of Zoology and Entomology.
For primary bibliographic entry see Field 5C.
W83-02061

DEVELOPMENT AND APPLICATION OF MODELS FOR ANALYZING WATER RESOURCE USE AND DEVELOPMENT WITHIN A REGIONAL FRAMEWORK OF ECONOMIC GROWTH AND ENVIRONMENTAL QUALITY,
Iowa State Water Resources Research Inst., Ames.
J. F. Timmons.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-167932, Price codes: A05 in paper copy, A01 in microfiche. Publication No ISWRRI-70, December 1982. 71 p, 7 Ref. OWRT B-037-IA(2) and B-042-IA(2), 14-31-0001-3887, 14-31-0001-3957.

Descriptors: Non-point pollution sources, Economics, *Iowa, *Erosion control, Model studies, Water policy, Water quality, Land use management, Soil erosion.

Soil sediment and associated materials from agricultural sectors were indicated to be one of the principle substances in determining the water quality. Phosphorus compounds and pesticides were shown to be pollutants associated with sediments. Taxation or effluent charges are discussed as policy instruments for maximizing water quality in the control of point sources of pollutants. However, treatment standards rather than taxation on charges were shown to be more effective in the control of diffused sources, such as agricultural practices. Regional control by some form of basin-wide authority was shown to be best for achieving and maintaining quality levels as inherent components or water quality management. Responsibilities of this authority should include the establishment of comprehensive land use policy, which can specify alternative means for controlling soil erosion at the source. To secure an optimal allocation of water quality over time, it may be necessary to specify water quality rights in terms of a tenure contract between the public representative and the land user.
W83-02063

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

THE POLICY DELPHI AND PUBLIC INVOLVEMENT PROGRAMS,
Planning and Management Consultants Ltd., Carbondale, IL.
N. Baumann, O. Ervin, and G. Reynolds.
Water Resources Research, Vol 18, No 4, p 721-728, August 1982, 4 Tab, 21 Ref.

Descriptors: *Planning, *Public participation, Water resources development, *Delphi Method, Policy Delphi, Cahokia Canal, *Illinois, Water policy, Flood control, Sediment control, Environmental quality, Recreation, Alternative planning.

The Policy Delphi, a derivative of the Delphi Method for eliciting expert opinion for planning purposes, was part of the public involvement program in a U. S. Army Corps of Engineers flood control project, the Cahokia Canal on the Mississippi River in Illinois. The Policy Delphi, as compared to conventional Delphi, is less oriented toward the long-range future, uses informed panelists rather than experts, identities conflict as well as consensus, and emphasizes discovery and articulation of policy alternatives and options. A panel of 33 persons was chosen, based on reputation, area representation, interest representation, and availability. The Policy Delphi proved to be a useful technique in acquiring informed opinion about the water resources issues and alternatives. Of the seven problems considered by the panelists, sedimentation was considered most serious, followed closely by environmental quality, flooding, and recreation opportunity. Erosion and water quality were considered much less important than the other problems. Subsequently, alternative courses of action were evaluated and the areas of agreement and disagreement identified. The Policy Delphi, which used individual interviews and questionaires, avoided the problems of face-to-face conflict and dominant personalities commonly encountered in committee meetings. Results from the Policy Delphi in this case could have been improved by using a somewhat larger panel, further iteration with feedback and interspersed information, and requiring panelists to elaborate on reasons for choices. (Cassar-FRC)
W83-01761

A FINANCIAL ASSESSMENT OF VIRGINIA'S OUTDOOR RECREATION PLANNING,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6B.
W83-01803

VERIFICATION OF WATER QUALITY MODELS,
Manhattan Coll., Bronx, NY. Environmental Engineering and Science Program.
R. V. Thomann.

Descriptors: *Water quality, *Model studies, Eutrophication, Lakes, Calibration, *Verification, Water quality control, Environmental protection, Decision making, *Lake Ontario.

The basic concepts of water quality models are reviewed, and the need to recognize calibration and verification of models with observed data is stressed. Post-auditing of models after environmental control procedures are implemented is needed to determine true model prediction ability. The direct questions in the decision-making arena related to model credibility are examined by several quantitative measures of model performance: regression analysis between observed and computed values, relative and root mean square errors and comparison of means. An analysis of 15 DO water quality models indicated median relative error of 10%. For a eutrophication model of Lake Ontario, application of quantitative verification measures indicated that the credibility of the calculations decreased as the model was applied to smaller

scale phenomena. Inclusion of more complex kinetics reduced median relative error across five variables and over a 10 year modeling framework from 32% to 22%. It is suggested that quantitative measures of water quality model credibility be integrated into the modeling analysis whenever possible. (Baker-FRC)
W83-01947

6B. Evaluation Process

A FINANCIAL ASSESSMENT OF VIRGINIA'S OUTDOOR RECREATION PLANNING,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Economics.
L. Shabman, and R. Ostrander.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-154468, Price codes: A03 in paper copy, A01 in microfiche. Virginia Water Resources Research Center Bulletin 136, Blacksburg, August 1982. 42 p, 1 Fig, 10 Tab, 18 Ref. OWRT A-089-VA(2).

Descriptors: *Recreation, *Outdoor recreation, *Recreation planning, *Land use, *Public investment, *Linear programming, *Virginia, Alternative planning, Costs, Budget constraints, User fees.

In recent years, large public budgets for recreation have encouraged state agencies to develop planning tools that can yield more effective spending decisions. Such tools are used to project future recreation participation and the capacity of recreation facilities for specific activities. A recreation facility need is said to exist when projected participation exceeds current capacity. Once needs are identified, expenditures for recreation development can be directed to priority needs. However, since funds available for recreation development are limited, all identified facility needs may not be met. This study was guided by two principal questions: (1) Are current recreation planning standards in Virginia realistic, i.e., can currently specified recreation needs be met within expected budget constraints. (2) What additional revenue sources might be developed to support recreation development. The study used a linear programming model to reach the conclusion that the state's recreation planning procedures are not realistic since its expressed future recreation needs cannot be met within projected budget constraints. It recommends revising current recreation planning practices and suggests that the state obtain additional revenue to meet the recreation needs by user fees combined with increased general tax revenues.
W83-01803

WATER SYSTEM REHABILITATION WAS A TIMELY INVESTMENT,
W. Eakins.
Public Works, Vol 113, No 10, p 44-47, October, 1982. 1 Fig, 2 Tab.

Descriptors: *Rehabilitation, *Water pressure, *Firefighting, Water distribution, Lynn, *Massachusetts, Water mains, Cleaning, Linings, Capacity, Water demand, Water supply.

The City of Lynn, Massachusetts, water system was able to deliver 50 million gallons of water during the 15-hour conflagration on November 18, 1981, which destroyed or damaged 26 industrial buildings. Fortunately, the old cast iron pipes, installed before 1892, had been cleaned and lined as part of a rehabilitation program implemented in the 1970's. Computer analysis after the fire indicated that the extraordinary demands of firefighting, 40,000 gpm, could not have been met if cleaning and lining had not been undertaken. Required pressures on the unrehabilitated system would have been extremely negative at the 7 junctions in the fire area. (Cassar-FRC)
W83-01835

MEASURING EFFECTIVENESS OF INFILTRATION/INFLOW REMOVAL,
RJN Environmental Associates, Inc., Wheaton, IL.
R. E. Nelson, and R. L. Bodner.
Public Works, Vol 113, No 10, p 50-52, October, 1982. 2 Fig, 2 Tab, 3 Ref.

Descriptors: *Sewer infiltration, *Economic evaluation, *Rehabilitation, Infiltration, Rate of return, Wastewater collection, *Illinois, Wheaton.

A suggested guide for economic evaluation of infiltration/inflow (I/I) removal includes annual costs and I/I removal costs. These values, determined before and after sewer rehabilitation, produce the annual savings and % return on investment. Infiltration determination methods currently in use are not very accurate. However, inflow may be determined by establishing a relation between measured inflow and rainfall intensity during partial pipe flow and then estimating peak flow for any storm frequency. The monitoring and evaluation procedure is illustrated with two case studies, Streamwood and the Arrowhead subdivision of Wheaton, both in Illinois. Annual costs for the Arrowhead sewer system were $31,698 before rehabilitation and $18,357 after rehabilitation, for a return on investment of 13.5%. (Cassar-FRC)
W83-01836

SELECTION OF OPTIMUM STORM FREQUENCY FOR SEWER STUDIES,
RJN Environmental Associates, Inc., Wheaton, IL.
R. J. Nogaj, and G. A. Braam.
Journal of the Water Pollution Control Federation, Vol 54, No 10, p 1401-1497, October, 1982. 5 Fig, 4 Tab, 2 Ref.

Descriptors: *Frequency analysis, *Cost analysis, *Storm sewers, Storm drains, Municipal sewage, Storms, Storm wastewater, Storm-overflow sewers, Design criteria.

A marginal cost technique is presented which can be used in studies of sanitary sewer systems to develop a rational cost-effective rehabilitation program. Selection of an optimum storm frequency allows for proper sizing and location of relief sewer lines and also for rational sizing of wet weather treatment facilities. The technique provides a basis for developing the cost to reduce sanitary sewer backups, treatment plant bypasses, and other local water pollution effects associated with a storm event. The technique is important for estimating the probability of system overloading during an intense storm event. It also provides a mathematical basis for refuting the notion that sanitary sewer backups, surcharging and treatment plant overloads can be eliminated simply by sewer system rehabilitation without regard to storm frequency. It is noted that the level of storm protection is generally independent of the level of percent inflow removal that would be obtained through a sanitary sewer rehabilitation program. The optimum level of storm protection is related to the size of the sanitary sewer system. The optimum storm protection for a sanitary sewer system is not related to the storm event used for the design of the storm sewer system. (Baker-FRC)
W83-01934

ECONOMIC ANALYSIS OF REHABILITATION OF WATER MAINS,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
T. M. Walski.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 108, No WR3, p 296-308, October, 1982. 8 Fig, 3 Tab, 10 Ref.

Descriptors: *Water mains, *Rehabilitation, *Economic analysis, Pipes, Water distribution, Linings, Pumping head, Carrying capacity, Pipe flow, Cost-benefit analysis, Benefits, Cleaning, Costs, Energy loss, Friction.

A method for determining the cost effectiveness of water transmission line rehabilitation is developed. The decision to clean and line a pipe depends on the rehabilitation costs, the price of energy, the incremental cost of pumping capacity, the peak and average flow in the pipe, the normal diameter, the interest rate, the year in which the pumping equipment will be upgraded or replaced, and the Hazen-Williams C factor before and after rehabilitation. This method is appropriate for linens fed directly from pumps but not for small distribution lines sized for fire flow and being fed from storage tanks. Examples are given for two cases: (1) flow is not significantly changed by pipe rehabilitation, and (2) flow changes significantly because the system is looped to the extent that a change in carrying capacity affects flow. A sensitivity analysis is graphically presented to show the effects of different variables on the decision to rehabilitate a pipe. The following factors favor rehabilitation: low rehabilitation costs, high energy costs, high flows (greater frictional losses), high change in pump cost per foot head loss, large pipe diameter, and a more highly looped system. (Cassar-FRC)
W83-01937

DEVELOPMENT AND APPLICATION OF ALLOCATION CRITERIA FOR WATER USES AND USERS IN MAXIMIZING VALUE PRODUCTIVITY OF WATER SUPPLIES,
Iowa State Univ., Ames. Dept. of Economics.
For primary bibliographic entry see Field 3F.
W83-01953

INSTITUTIONAL ISSUES AFFECTING WATER SUPPLY DEVELOPMENT: ILLUSTRATIONS FROM SOUTHEASTERN VIRGINIA,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
W. E. Cox, and L. A. Shabman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-167940, Price codes: A09 in paper copy, A01 in microfiche. Virginia Water Resources Research Center, Blacksburg, Completion Report, August 1982. 189 p, 15 Tab. OWRT A-076-VA(4).

Descriptors: *Municipal water supply, *Institutional constraints, Environmental protection, Economic analysis, *Virginia, *Interbasin transfer, Groundwater development, Water law, Administrative permitting, Water conservation, Interjurisdictional conflict, *Interstate conflict, Water resources planning, Riparian rights, Natural flow doctrine, Water resources development, Future planning, Projected planning, Water allocation policy, Interjurisdictional transfer.

This report focuses on the area south of Hampton Roads, Virginia (cities of Norfolk, Suffolk, Chesapeake, Virginia Beach) as a case study of the water supply development process. Recent droughts have emphasized limitations on existing supplies and heightened awareness of the need to expand them. Several plans have been proposed but have met with strong opposition. In the absence of a regional solution, several localities have acted independently to expand their own supplies. This report provides background information on (1) institutional considerations affecting choice of a particular plan and (2) relative costs of the available supply management options. The institutional analysis addresses existing laws and administrative programs for water resources planning and development, water rights, issues, and legislative and administrative constraints on water supply development. Cost analyses are presented for different combinations of surface water development, groundwater development, system interconnection, and demand management. Impacts of institutional factors on the alternative managment stategies are evaluated. The report concludes that the least-cost strategy for expanding water supplies in the study area is a combination of the alternatives implemented in a phased approach rather than any single development action. Institutional issues are a major factor in the selection of a management strategy. In the event that an institutional constraint results in the selection of a more costly rather than a less costly alternative, the additional expenditure represents a cost attributable to the maintenance of the responsible institutional constraint. Thus, the water supply planning process provides an ongoing assessment of the existing institutional framework. This study raises questions concerning the adequacy of Virginia's existing institutional structure for water supply decision

making and concludes that re-evaluation of the traditional, decentralized approach is needed.
W83-02064

THE POTENTIAL ROLE FOR WATER RESOURCES RESEARCH IN THE DEVELOPMENT OF A STATE WATER RESOURCES PLANNING PROCESS IN VIRGINIA,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Economics.
L. Shabman, and W. E. Cox.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-167957, Price codes: A07 in paper copy, A01 in microfiche. Virginia Water Resources Research Center, Completion Report, January 1983. 138 p, 4 Fig, 72 Ref. OWRT A-095-VA(1).

Descriptors: *Water resources planning, Planning, Water resources management, Water resources development, Decision making, *Future planning, Projected planning, Urban planning, *State planning process, Planning process, Water policy, Conflict management, *Research priorities, *Water research, Water supply, Water quantity, Water allocation, *Virginia, York River Basin.

This report reviews and describes the concepts behind and the planning for water resources management in the United States, with examples from Virginia, California, Illinois, Nebraska, New York, Oregon, Utah, Washington, Wyoming, and Georgia. It describes the current trend in the states away from traditional planning, which focuses on comprehensive plan development, to a problem-focused planning, which stresses the management of interest-group conflict and negotiation. Based on the evaluation of alternative approaches to state water planning as displayed by the states used as examples, the report makes specific recommendations to facilitate the implementation of Virgina's 1982 statutory mandate to develop a water management plan for the state. A literature review and interviews with persons knowledgeable about water resources planning in Virginia and other states were conducted and are integrated into the report in narrative form. The report identifies key components of a state water planning process; discusses state water planning as it has evolved since 1965; summarizes Virginia's water resources problems, using the York River Basin as a case illustration; suggests strategies for implementing water planning authority in Virginia; and recommends research priorities to support a planning process in Virginia (research on policy, conflict management strategies, and analytical tools for framework and appraisal planning). Specific research needs are noted for each of the three main areas.
W83-02065

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

SUMMARY: SYMPOSIUM ON INLAND WATERWAY USER CHARGES, CAPITAL RECOVERY COST ISSUES, AND THEIR RELATIONSHIP TO NATIONAL TRANSPORTATION POLICY,
L. E. Haefner, and W. Dye.
Transportation Research Record, Vol 825, p 17-18, 1981.

Descriptors: *Inland waterways, *Transportation, *User charges, Water management, *Policy making, *Symposium, Cost allocation, Cost analysis, Navigable rivers, Navigation, Water costs, Water policy, Data collections, Capital.

In July of 1978, the Committee on Inland Waterways of the Transportation Research Board conducted a symposium on inland waterway user charges and their relationship to national transportation policy. Opinions on user charges differed substantially among different interest groups. The U.S. Army Corps of Engineers is charged with the operation, maintenance, and construction of navigation and flood control projects on inland waterway systems. The Corps maintains an on-line data collection and analysis program called the Inland Navigation Systems Analysis (INSA) program which provides a data base for modeling projections and analyzing the operation, maintenance, and expansion of the waterway system on a one-month delay basis. The INSA program has established a multimodal allocation model that uses commodity flows and performs an allocation to the various transportation modes. Two other models involve allocations of commodity movements and determine the effects of technological and structural changes on the waterway fleet. Water carriers maintain that barge transport is more energy efficient than rail transport and that user charges are weighted unfairly. Waterway operators also oppose the imposition of user charges involving intermodal diversion or competition. Railway operators argue that maintenance of inland waterways is subsidized by taxpayers. A senate committee spokesman advocated a percentage of recovery as necessary for a rational subsidy program for the inland waterway system, while a Department of Transportation spokesman advocated a cost-recovery user charge in the absence of some overriding social objectives or significant non-user benefits. It is hoped that data from the Corps of Engineers will provide a basis for policymaking regarding user charges for inland waterways. (Geiger-FRC)
W83-01806

WATER DISTRIBUTION SYSTEMS: A SPATIAL AND COST EVALUATION,
Municipal Environmental Research Lab., Cincinnati, OH.
For primary bibliographic entry see Field 5F.
W83-01936

COST ESTIMATING FOR CONVENTIONAL WATER TREATMENT,
Municipal Environmental Research Lab., Cincinnati, OH.
For primary bibliographic entry see Field 5F.
W83-01940

THE IMPACT OF WATER SYSTEM PRICING ON CONSUMPTION AND CONSERVATION,
Mississippi Univ., University. Bureau of Business and Economic Research.
For primary bibliographic entry see Field 3D.
W83-02062

6D. Water Demand

TREAT THE WELLS WITH CAUTION,
D. Cuzovic.
Aqua, No 5, p 31-32, 1982.

Descriptors: *Water supply, *Water management, *Municipal water, Groundwater management, Belgrade, *Yugoslavia, Wells, Water policy, Water demand.

The city of Belgrade, which extracts all but 7% of its water from groundwater wells, has nearly reached the limit of available supplies from this source. Costs of additional wells at distant sources are high, and some of the newly drilled wells drain water tables already supplying water to the system. Use of river water as a municipal supply is very unpopular among the consumers. However, policies must be changed to incorporate the use of river water in the management scheme. (Cassar-FRC)
W83-01813

HIGH PLAINS LOW ON WATER.
World Water, Vol 5, No 9, p 17-19, 23, 25, September, 1982. 3 Fig.

Descriptors: *Water transport, *Water supply, Water resources development, Groundwater supplies, Water demand, Irrigation, Water shortage, *Ogallala aquifer, Aquifers, Groundwater management, *High Plains area.

Water is being drawn from the Ogallala Aquifer faster than it is being replenished. The Ogallala is the chief source of supply for irrigation water throughout the High Plains area, which includes parts of six states. Irrigation demands account for 90% of the fresh water used in the High Plains. Alongside the agricultural boom has come a rapid expansion of associated businesses supplying finance, pumps, pipes, sprinklers, fertilizers, pesticides, processing plants, and farm equipment. The Corps of Engineers was instructed to look at ways of importing extra water supplies to the High Plains, and the Commerce Secretary to come up with a plan for allocating and distributing water equitably if such transfers were to be part of a reasonable solution. Comprehensive plans were produced by the Corps for major transfers, presuming availability of the necessary amount of water from neighboring states. The analyses showed benefits from water transfer schemes. However, the report went on to demonstrate that groundwater depletion would continue during the study period, and that import volumes would have to increase after the year 2020 unless land were to be lost to irrigation at that time. (Baker-FRC)
W83-01820

RELATIVE IMPORTANCE OF GROUNDWATER AND SURFACE-WATER SUPPLIES TO OIL-SHALE DEVELOPMENT, PICEANCE BASIN, COLORADO,
Geological Survey, Reston, VA. Water Resources Div.
W. M. Alley.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $6.50 in paper copy, $3.50 in microfiche. Geological Survey, Open-File Report 82-340, 1982. 46 p, 14 Fig, 2 Tab, 28 Ref.

Descriptors: *Groundwater, *Surface water, *Oil shale, *Water resources development, Surface-groundwater relations, Water use, Model studies, Synethetic hydrology, *Colorado, Colorado River basin, Piceance basin.

A sensitivity analysis was perfomed of the required active storage capacity (VMAX) of a hypothetical reservoir on the White River to different assumptions about water demands for oil-shale development and the contributions from various sources of water. Estimates of VMAX were found to be sensitive to estimates of the supply of water available from the oil-shale aquifers. For example, the current estimate of average natural recharge to the oil-shale aquifers is approximately equal to the amount of water required by an oil-shale industry producing 250,000 barrels of oil per day and requiring 3 barrels of water per barrel of shale-oil produced. Estimates of VMAX were also sensitive to estimates of the supply of water available from the Colorado River and the requirements for downstream releases on the White River. The sensitivity of VMAX to use of water from the four main streams in the Piceance basin (Parachute, Roan, Piceance, and Yellow Creeks) was less than its sensitivity to these factors. Compared to the uncertainty in other factors, water-supply estimates are shown to be insensitive to uncertainty in evaporation estimates. A transient analysis was performed using a synthetic streamflow model to generate 500 equally likely periods of monthly inflows to the hypothetical reservoir. An oil-shale industry was assumed to expand from 0 to 1 million barrels of oil per day over a 30-year time period, and mine water was assumed to be available at an increasing rate that averaged one-half the current estimated natural recharge rate to the Piceance basin. Use of this mine water to supply part of the water demand resulted in reductions in surface-storage requirements (VMAX) on the order of 15-20 thousand acre-ft over many of the 500 streamflow sequences. (USGS)
W83-01854

A SYSTEM FOR MEASURING PUBLIC USE OF ROSS BARNETT RESERVOIR DISTRICT,
University of Southern Mississippi, Hattiesburg. Dept. of Recreation.
W. H. Bumgardner, and C. Burchell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-168013, Price codes: A04 in paper copy, A01 in microfiche. Water Resources Research Institute Completion Report, Mississippi State Univ., Mississippi State, December 1982. 57 p, 13 Tab, 11 Ref, 3 Append. OWRT B-024-MS(1), 14-34-0001-0227.

Descriptors: *Reservoirs, Reservoir operation, *Recreation, *Recreation demand, *Recreation facilities, Public access, Parks, Public participation, Social participation, Water management, *Mississippi, Ross Barnett Reservoir district.

The objective of this study was to develop a system for measuring (estimating) public use of Ross Barnett Reservoir District which is located near Jackson, Mississippi. Surveillance of visitation and usage during the recreation seasons comprising the summers of 1980 and 1981 enabled the identification of all significant points of access to the reservoir. An integrated estimation system, employing the use of traffic counters, camper registrations, infrared counting devices, and activity timelogs, has been designed and recommended for use by the Pearl River Valley Water Supply District. Supplemental data, procedural guidelines and a computer program have been developed for operationalizing the system. The system was designed in a manner that accounts for unique characteristics of the reservoir district such as multiple and, in some instances, uncontrolled access as well as reservoir usage by a large onsite residential population.
W83-02071

HYDROPOWER FINDS NEW MARKET IN THE THIRD WORLD,
Journal of Commerce, New York.
L. Ioannou.
Civil Engineering (New York), Vol 52, No 10, p 51-55, October, 1982.

Descriptors: *Water resources development, *Hydroelectric plants, *Hydroelectric power, Electric power, Electric power production, Powerplant, Asia, Argentina, China, United States, Pakistan, Philippines, India, Third World Countries, Nigeria, Energy sources.

The attractions of hydropower as an inexpensive, non-polluting, sustainable source of energy seem to be making hydro a booming field in the Third World. The nature of the hydropower market and its potential for growth have influenced some markets to restructure in order to compete. Work in China, the Philipines, Pakistan and various locations in Asia is cited. One project in Argentina has as one of its purposes the attraction of settlement to the area. The project, Casa de Piedra, is near Neuquen on the Colorado River, where its generating capacity will be 230 megawatts. (Baker-FRC)
W83-02095

6E. Water Law and Institutions

INTERSTATE WATER PROBLEMS CONCERNING THE ESCATAWPA RIVER--THE NEED FOR JOINT DEVELOPMENT BY ALABAMA AND MISSISSIPPI,
Alabama Univ., University. School of Law.
H. Cohen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-154427, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Institute Completion Report, March 1982, Auburn, Alabama. 29 p. OWRT A-082-ALA(1), 14-34-0001-1101.

Descriptors: Legal aspects, *Riparian rights, *State jurisdiction, *Water law, *Water rights, Riparian waters, River flow, *Alabama, *Mississippi, *Interstate rivers, Interstate compacts, *Escatawpa River.

The Escatawpa River flows from Alabama into Mississippi and joins the Pascagoula River near the Mississippi Sound. Because of the need for fresh water in Jackson County, Mississippi, the Escatawpa River is an important resource. Mississippi authorities argue that Mobile has taken unusually large quantities of the Escatawpa River, depriving Jackson of its rights in the river. Alabama authorities state unequivocally that no water has ever been taken from the river by the Mobile Water Service System. This report constitutes an effort to seek legal answers to the problems raised by these facts. Litigation between the two states should only be utilized after all other attempts to settle the dispute have failed. An Interstate Compact resulting from negotiation involving the legislatures of both states is a starting point. However, the seriousness of the difficulties by water users in the two states is not at a high-tempered stage; therefore such high-level negotiation at this time is unlikely.
W83-01796

HOW MUCH WATER CLEAN-UP DO WE WANT TO PURCHASE,
Mississippi State Univ., Mississippi State. Div. of Business Research.
For primary bibliographic entry see Field 5D.
W83-01842

LEGAL IMPLICATIONS OF COASTAL EROSION IN LOUISIANA,
Louisiana State Univ., Baton Rouge. Sea Grant Legal Program.
P. Hribernick, and M. Wascom.
In: Proceedings of the Conference on Coastal Erosion and Wetland Modification in Louisiana: Causes, Consequences, and Options, Baton Rouge, Louisiana, October 5-7, 1981, D. F. Boesch, ed., Fish and Wildlife Service Report FWS/OBS-82/59, September 1982. p 128-139, 51 Ref.

Descriptors: *Erosion, *Land tenure, *Legal aspects,*Riparian rights, *Louisiana, Land reclamation, Coastal waters, Littoral zone.

Erosion in the coastal zone of Louisiana has serious legal consequences for all property owners. When a Louisiana private property owner's lands are subjected to erosion, the land owner is placed in an adversarial position with the State. If the private property abuts a navigable river, the riparian loses to the state any property which erodes, but gains ownership of any alluvion that builds up along his river bank. If the private property abuts a navigable lake or the coastline, the littoral owner is placed in a 'no win' situation. Any portion of his land which erodes is lost to the state and ownership of any new land created between his property line and the water vests in the State, cutting the littoral owner off from the water by a strip of state-owned land. However, State law generally allows the private land-owner to reclaim any land lost to erosion. When the State's coastline is subjected to erosion, the State is placed in an adversarial position with the Federal Government. As erosion forces the coastline landward, the State's territorial sea theoretically moves a corresponding distance landward. Unlike the private landowner, the Federal Government does not give the State a chance to reclaim lands lost to erosion. As a result, Louisiana may ultimately lose valuable offshore mineral rights to the Federal government if the courts are ever asked to recompute the State's coastline which is the baseline for measurement of the territorial sea. (Moore-SRC)
W83-01868

WATER RESOURCES MANAGEMENT: A DESCRIPTION OF COMPREHENSIVE MANAGEMENT SYSTEMS IN THE STATES AND FUTURE RESEARCH NEEDS,
Old Dominion Univ., Norfolk, VA. Dept. of Urban Studies and Public Administration.
W. A. Gibson, and L. I. Ruchelman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-167544, Price codes: A10 in paper copy, A01 in microfiche. Virginia Water Resources Research Center Completion Report, Virginia Polytechnic Institute and State University, Blacksburg, October, 1982, Vols I and II. 203 p, 10 Fig, 11 Tab, 3 Append, 35 Footnotes. OWRT A-096-VA(1,2).

Descriptors: *Water resources management, *Water law, Water management, *Comprehensive planning, Reparian law, *Florida, *Georgia, *New Jersey, State governments, Future planning, Regulations, *State juridiction, Legal aspects, Administration, Research needs, Research priorities.

Water resources management on the state level reflects both environmental conditions and the institutional-legal structure. As new water needs develop, state government strives to modify existing procedures to meet these needs. Such change usually comes about incrementally rather than through broad-scale, rapid transformation. This general pattern was observed in this study of water resource management in Florida, Georgia, and New Jersey, three riparian-law states that have been especially innovative. Each state tends to map out a different approach to its water problems. The three states are viewed as representing different water management models. Florida represents the federalist-regulatory model, Georgia represents the unified-regulatory model, and New Jersey represents the home-rule/strong planning model. Each of these models is examined for its particular advantages, which should be weighed when being considered for adoption in other settings. Each of the states is also assessed as to the extent to which they address certain critical areas of water management. This allows for comparison of planning and regulatory comprehensiveness. Such data can then be used as baseline information to assess other states and to identify possible gaps in water resource management.
W83-01951

NEW CHALLENGES IN THE GREAT LAKE STATES TO BANNING PHOSPHORUS IN DETERGENTS,
For primary bibliographic entry see Field 5G.
W83-01967

NPDES RULES FOR INDUSTRIAL DISCHARGERS: NEW OBLIGATIONS, NEW OPPORTUNITIES,
Smith and Schnacke, Dayton, OH.
For primary bibliographic entry see Field 5G.
W83-01968

AN ANALYSIS OF TWO PRINCIPLE LEGAL/INSTITUTIONAL CONSTRAINTS TO AGRICULTURAL WATER CONSERVATION IN THE ELEVEN WESTERN STATES.
Teknekron Research, Inc., Berkeley, CA. Industrial Planning Div.
For primary bibliographic entry see Field 3F.
W83-02051

INSTITUTIONAL ISSUES AFFECTING WATER SUPPLY DEVELOPMENT: ILLUSTRATIONS FROM SOUTHEASTERN VIRGINIA,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6B.
W83-02064

THE POTENTIAL ROLE FOR WATER RESOURCES RESEARCH IN THE DEVELOPMENT OF A STATE WATER RESOURCES PLANNING PROCESS IN VIRGINIA,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6B.
W83-02065

6F. Nonstructural Alternatives

WHO IS KILLING THE RHINE,
For primary bibliographic entry see Field 5G.
W83-01838

WATER RESOURCES AND GROWTH MANAGEMENT IN SOUTH FLORIDA,
Hole, Montes and Associates, Inc., Naples, FL.
S. W. Hole, and P. B. Rhoads.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 108, No WR3, p 286-295, October, 1982. 2 Fig, 4 Ref.

Descriptors: *Water management, *Land development, *Growth, Management, Water resources development, Land management, Groundwater management, Resources management, *Florida, Land

use planning, Drainage, Zoning, Nonstructural alternatives, Planning, Urban planning, Regional planning, Decision making, Local governments, Wetlands, Surface water, Permits Water use, Water allocation, Drought, Flood control.

Water resources management in Southeast Florida is closely related to land development. Complex problems pose difficulties for water managers--54-60 inches of average annual rainfall with extremes from 35 to 100 inches, a May-October wet season during which 70% of rainfll occurs, flat topography, high evapotranspiration, salt water intrusion of aquifers, and sensitive wetland ecosystem. The South Florida Water Management District, created in 1972, has comprehensive water management functions for the 18,000 sq mi area. It must maintain a balance in growth so that essential services can be provided at a reasonable cost and natural resources are not intolerably affected. Water use is regulated by a program requiring permits for all withdrawals in excess of 100,000 gpd. Applicants must show a reasonable-beneficial use, not interfering with a present use and consistent with public interest. Resource availability per se is not a constraint on long-term growth in this region, but water utilities are struggling to keep up with demand. Moratoria on connection serve as a control on building and development. Surface water management is closely related to development. Zoning restricts the type of building for land parcels to minimize flood damage to homes, prevent damage to the environment, and maintain the land area necessary for water management purposes. This management has had little effect on intensity or magnitude of growth but a moderate effect on distribution and timing. During the past decade the District has supported local government growth management efforts by coordinating plans and regulations and by providing help in decision making. (Cassar-FRC)
W83-01895

SEASONAL TREATMENT AND VARIABLE EFFLUENT QUALITY BASED ON ASSIMILATIVE CAPACITY,
Stanley Consultants, Inc., Atlanta, GA.
M. C. Boner, and L. P. Furland.
Journal of the Water Pollution Control Federation, Vol 54, No 10, p 1408-1416, October, 1982. 11 Fig, 5 Tab.

Descriptors: *Waste assimilative capacity, *Wastewater treatment, *Water quality, *Seasonal variations, Streams, Rivers, Cost analysis, Financial aspects, Nitrification, Water treatment facilities, *Georgia, Water pollution control, Water resources development.

Increasing pollution control costs and associated energy consumption are beginning to direct attention toward more effective use of resources. Seasonal nitrification permitting, as proposed in Georgia by the EPA, is the first step leading to more effective use of assimilative capacity of receiving streams. The use of stream assimilative capacity may eventually progress to the point of regional economic assignments of treatment responsibility. For example, the cost to cool all or a portion of the thermal discharge on a seasonal basis might be studied and compared to the cost to provide higher levels of wastewater treatment in Atlanta and other municipalities in order to determine the lowest total cost system for the region. There may be cost savings resulting from economies of scale if various treatment levels are assigned to the different wastewater treatment facilities. The overall economic optimization of effluent cooling and effluent treatment on a seasonal basis would require governmental and industry cooperation and possibly financial transfers. With the ability to regulate flows in streams and with calibrated modeling capabilities, optimizing wastewater treatment economics to make better use of available stream assimilative capacity should be considered. (Baker-FRC)
W83-01935

MANAGEMENT SCHEME FOR DEVILS LAKE BASIN WETLANDS,
North Dakota State Univ., Fargo.
For primary bibliographic entry see Field 4A.
W83-02050

PROTECTING DRINKING WATER SUPPLIES THROUGH WATERSHED MANAGEMENT. A GUIDEBOOK FOR DEVISING LOCAL PROGRAMS,
North Carolina Univ. at Chapel Hill. Center for Urban and Regional Studies.
For primary bibliographic entry see Field 5G.
W83-02055

6G. Ecologic Impact Of Water Development

CONVERTING AN ESTUARY TO LAKE GREVELINGEN: ENVIRONMENTAL REVIEW OF A COASTAL ENGINEERING PROJECT,
Ministry of Transport and Public Works, Middelburg (Netherlands). Environmental Research Div.
H. L. F. Saeijs, and P. B. M. Stortelder.
Environmental Management, Vol 6, No 5, p 377-405, September, 1982. 22 Fig, 14 Tab, 33 Ref.

Descriptors: Water resources development, *Estuaries, *Flood protection, Flood control, Storms, Lake Grevelingen, Dams, Barriers, Lakes, Storm surges, Surges, *Netherlands, Environmental effects, Chlorides, Phosphates.

In order to guarantee protection from storm floods in the southwestern part of the Netherlands, the length of exposed coastline is being greatly reduced by the construction of dams and a storm surge barrier. As part of the Delta Project, the mouth of the Grevelingen estuary was closed in 1971. Due to the closure, tidal movement was eliminated, resulting in changes in environmental factors such as transparency and chloride and phosphate concentration. The number of plant and animal groups decreased. Large areas of sand flats and salt marshes which were formerly exposed to the tides were left high and dry. This caused enormous change for the biological communities living in these areas. The demand for recreational facilities and nature conservation and the need for a balanced realization of these main functions were explored. Water quality and ecosystem management were important parts of the program planning. One of the major concerns is to prevent further decrease in the chloride concentration and the number of species. A sluice was therefore put into operation in 1978, by means of which water was exchanged between the North Sea and Lake Grevelingen. The question of whether Lake Grevelingen will remain a salt water lake or become a fresh water lake will have to be decided in the future. (Baker-FRC)
W83-01784

THE JONGLEI CANAL--NEEDED DEVELOPMENT OR POTENTIAL ECODISASTER.,
Khartoum Univ. (Sudan). Inst. of Environmental Studies.
A. I. Moghraby.
Environmental Conservation, Vol 9, No 2, p 141-148, Summer, 1982. 4 Fig, 15 Ref.

Descriptors: *Diversion channels, *Swamps, *Canal construction, *Environmental effects, Water resources development, Evaporation, *Jonglei Canal, *Sudan, *Nile River, Sudd, Wetlands, Aquatic plants, Plankton, Wildlife, Fish, Irrigation water.

The author advocates implementation of Phase 1, but not Phase 2, of the Jonglei Canal, currently under construction in the Sudan to supply water during the dry season to regions downstream on the Nile River. The Phase 1 construction of the 20 million cu m per day capacity, 360 km long, 52 m wide, 4 m deep canal from Bor to the mouth of the Sobat River, would desiccate 10-15% of the present area of the Sudd, the 6,000 to 100,000 sq km (according to season) almost impassable swamp in this region. Phase 2, which would increase the capacity of the canal to 43 million cu m per day, use the equatorial lakes for storage, and improve other channels, would completely dry up the swamps. The Sudd is ecologically and economically important, supporting a rich flora and fauna and serving as a major gene reserve. The hydrology, physical characteristics, and ecology of the Sudd are reviewed. As water passes through the Sudd, total dissolved solids, Ca, Mg, K, and Si levels increase and Na, phosphates, and N are removed. Evaporation from this large surface is of hydrological importance. Vegetation includes many types of water plants, reeds, ferns, and woody plants. Diatoms and blue-green algae are the dominant phytoplankton. Lake zooplankton populations are destroyed in the falls before the water reaches the swamps, but rich populations develop in the fringe vegetation. Benthic flora and fauna are sparse. Of the 40 fish species, most tolerate oxygen deficient conditions and are detritus feeders. Animal wildlife, particularly crocodiles and birds, is abundant and diversified. (Cassar-FRC)
W83-01785

SALINITY-PRODUCTIVITY RELATIONSHIPS OF SELECTED PLANT SPECIES FROM THE SUISUN MARSH, CALIFORNIA,
California Univ., Davis. Dept. of Botany.
For primary bibliographic entry see Field 2I.
W83-01802

WETLAND LOSS DIRECTLY ASSOCIATED WITH CANAL DREDGING IN THE LOUISIANA COASTAL ZONE,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
W. B. Johnson, and J. G. Gosselink.
In: Proceedings of the Conference on Coastal Erosion and Wetland Modification in Louisiana: Causes, Consequences, and Options, Baton Rouge, Louisiana, October 5-7, 1981, D. F. Boesch, ed., Fish and Wildlife Service Report FWS/OBS-82/59, September 1982. p 60-72, 5 Fig, 6 Tab, 15 Ref.

Descriptors: *Canals, *Wetlands, *Canal construction, *Spoil banks, *Berms, *Bank erosion, *Louisiana, Navigation canals, Boating, Environmental effects, Dredging.

Manmade canals are a dominant feature of the Louisiana Coast, and there is evidence that this canal network contributes significantly to wetland loss, both directly and indirectly. Direct effects are the immediate conversion of wetland to canals and spoil banks during canal construction, and the subsequent widening of canals as their banks erode. The relationship between proposed canal widths specified in dredging permit applications and the actual wetland affected was studied at oil and gas well-access canals and the Louisiana Offshore Oil Port pipeline system. The average actual width of the newly dredged canals studied exceeded the width specified in the dredging permit by 13.4 m. The total width affected, including berm and spoil deposits, exceeded the permitted canal width by an average of 81.7 m. As canals age, they widen through erosion. The history of three old canal systems in coastal Louisiana was examined. All these canals continue to increase in width, and differences in their patterns of widening can be explained by boat traffic, length of time since construction, and substrate differences. Canals in areas of greatest boat activity widened at a rate of 2.58 m/yr, while those in areas of minimal boat activity widened at a rate of 0.95 m/yr. (Moore-SRC)
W83-01865

CANALS AND WETLAND EROSION RATES IN COASTAL LOUISIANA,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
R. E. Turner, R. Costanza, and W. Scaife.
In: Proceedings of the Conference on Coastal Erosion and Wetland Modification in Louisiana: Causes, Consequences, and Options, Baton Rouge, Louisiana, October 5-7, 1981, D. F. Boesch, ed., Fish and Wildlife Service Report FWS/OBS-82/59, September 1982. p 73-84, 7 Fig, 2 Tab, 12 Ref.

Descriptors: *Coastal marshes, *Canals, *Wetlands, *Erosion, *Louisiana, Substrates, Canal construction, Dredging, Ponds.

Canals have increased in area from practically zero at the beginning of the century to about 2.5% of the Louisiana coastal surface area in 1978. The annual increase in canal area is continuing to climb in 1981 as a result of new canal dredging and the widening of existing canals. The whole coast is not uniform with respect to canal density and land loss rates. There is general relationship between canal density and land loss rates in each hydrologic unit. The point at which canal density is zero is also where land loss rates are slightly below zero (a net gain). Land loss is high when canal densities are high. Land loss rates across the coastal zone since the 1890's, among hydrologic units, and within areas of similar substrates and equal distances to the coast are all positively related to estimates of canal density. Within 7 1/2' quadrangle maps, the new ponds in the marsh have appeared close to canals, not near natural channels. Coastwide, canal surface is about 10% of the total land loss. It is concluded that coastal erosion rates in Louisiana are largely an indirect result of canal dredging activities or use. The mechanism for the effect probably involves an alteration in wetland hydrology, but a complete understanding is presently lacking. (Moore-SRC)
W83-01866

EFFECTS OF WETLAND DETERIORATION ON THE FISH AND WILDLIFE RESOURCES OF COASTAL LOUISIANA,
Fish and Wildlife Service, Lafayette, LA.
D. W. Fruge.
In: Proceedings of the Conference on Coastal Erosion and Wetland Modification in Louisiana: Causes, Consequences, and Options, Baton Rouge, Louisiana, October 5-7, 1981, D. F. Boesch, ed., Fish and Wildlife Service Report FWS/OBS-82-59, September 1982. p 99-107, 33 Ref.

Descriptors: *Wetlands, *Wildlife habitats, *Coastal marshes,*Environmental effects, *Fisheries, Water resources development, *Louisiana, Sediments, Recreation, Channels, Drainage, Levees, Construction, Estuaries.

The vast wetlands of the Louisiana Coastal Region (LCR) are of national importance to fish and wildlife. These wetlands are winter habitat for one-fourth of the North American dabbling duck population, a large portion of the Mississippi Flyway's diving ducks, and over 400,000 geese. Coastal Louisiana also supports numerous other migratory birds, many of which nest in its wetlands. The LCR marshes produce the largest fur harvest in North America, and support the largest volume of estuarine-dependent fish and shellfish landings in the United States. Fish and wildlife related recreation in the LCR is also extensive, including over 5 million man-days of saltwater fishing in 1975 and 676,000 man-days of waterfowl hunting during the 1977-78 season. Prior studies documented an annual land loss rate of over 42.7 sq km (16.5 sq mi)/yr in the LCR. Most recent investigations indicate that this rate of wetland loss has more than doubled since 1956. Wetland deterioration, which is partially attributable to natural causes, has been greatly accelerated by human influences such as navigation channel excavation, agricultural drainage, and construction of mainline Mississippi River levees that have prevented freshwater and sediment overflow into adjacent subdelta marshes. Continued wetland deterioration may lead to serious declines in estuarine-dependent fish and shellfish harvest, fur catch, waterfowl habitat, and related fish and wildlife productivity. The U. S. Fish and Wildlife Service has long advocated freshwater diversion for habitat improvement in the Mississippi deltaic plain region and is participating in the evaluation of several freshwater diversion sites being investigated by the U. S. Army Corps of Engineers. It is anticipated that marsh restoration measures involving freshwater diversion and other approaches will also be financed by the State of Louisiana through its Coastal Environmental Protection Trust Fund. (Author's abstract)
W83-01867

COMPARISON OF EFFECTIVENESS OF MANAGEMENT OPTIONS FOR WETLAND LOSS IN THE COASTAL ZONE OF LOUISIANA,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
J. W. Day, Jr., and N. J. Craig.
In: Proceedings of the Conference on Coastal Erosion and Wetland Modification in Louisiana: Causes, Consequences, and Options, Baton Rouge, Louisiana, October 5-7, 1981, D. F. Boesch, ed., Fish and Wildlife Service Report FWS/OBS-82/59, September 1982. p 232-239, 1 Fig, 1 Tab, 23 Ref.

Descriptors: *Wetlands, *Coastal zone management, *Canal construction, *Diversion, *Sedimentation, *Erosion, *Louisiana, Mississippi River, Atchafalaya River, Deltas, Subsidence, Erosion, Flood control, Resource management.

The coastal wetlands of Louisiana, an area of 14,000 sq km, are currently experiencing an overall net loss of approximately 130 sq km/yr. The loss is cumulative, resulting from both natural and artificial causes. Natural causes include land subsidence, the deterioration of abandoned river deltas, and erosion by wave energy and storms. Human-induced land losses result from control practices, impoundments, and the dredging of canals and channels. The effectiveness of the following three management options was examined: management of the current land building of the Atchafalaya River; controlled diversion schemes on the lower Mississippi River; and strict regulatory control of canals within the coastal zone. Strict regulatory control of new canals could reduce future land loss rate by 30 to 40 sq km/yr. This compares with 1 to 3 sq km/yr for controlled diversion plans, and 18 sq km/yr for the land-building processes of the Atchafalaya River. The following measures are recommended to combat wetland loss: management of the Atchafalaya River for maximum land building; use of controlled diversions along the Mississippi River and strict regulatory control of canals within the Louisiana wetland system. (Moore-SRC)
W83-01870

ATLAS OF THE SPAWNING AND NURSERY AREAS OF GREAT LAKES FISHES; VOLUME I, SPAWNING AND NURSERY AREAS OF GREAT LAKES FISHES: A SUMMARY BY GEOGRAPHIC AREA,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
For primary bibliographic entry see Field 7C.
W83-01871

ATLAS OF THE SPAWNING AND NURSERY AREAS OF GREAT LAKES FISHES; VOLUME II, LAKE SUPERIOR,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
For primary bibliographic entry see Field 7C.
W83-01872

ATLAS OF THE SPAWNING AND NURSERY AREAS OF GREAT LAKES FISHES; VOLUME III, ST. MARY'S RIVER,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
For primary bibliographic entry see Field 7C.
W83-01873

ATLAS OF THE SPAWNING AND NURSERY AREAS OF GREAT LAKES FISHES; VOLUME IV, LAKE MICHIGAN,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
For primary bibliographic entry see Field 7C.
W83-01874

ATLAS OF THE SPAWNING AND NURSERY AREAS OF GREAT LAKES FISHES; VOLUME 5, LAKE HURON,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
For primary bibliographic entry see Field 7C.
W83-01875

ATLAS OF THE SPAWNING AND NURSERY AREAS OF GREAT LAKES FISHES; VOLUME VI, ST. CLAIR RIVER,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
For primary bibliographic entry see Field 7C.
W83-01876

ATLAS OF THE SPAWNING AND NURSERY AREAS OF GREAT LAKES FISHES; VOLUME VII, LAKE ST. CLAIR,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
For primary bibliographic entry see Field 7C.
W83-01877

ATLAS OF THE SPAWNING AND NURSERY AREAS OF GREAT LAKES FISHES; VOLUME VIII, DETROIT RIVER,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
For primary bibliographic entry see Field 7C.
W83-01878

ATLAS OF THE SPAWNING AND NURSERY AREAS OF GREAT LAKES FISHES; VOLUME IX, LAKE ERIE,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
For primary bibliographic entry see Field 7C.
W83-01879

ATLAS OF THE SPAWNING AND NURSERY AREAS OF GREAT LAKES FISHES; VOLUME X, NIAGARA RIVER,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
For primary bibliographic entry see Field 7C.
W83-01880

ATLAS OF THE SPAWNING AND NURSERY AREAS OF GREAT LAKES FISHES; VOLUME XI, LAKE ONTARIO,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
For primary bibliographic entry see Field 7C.
W83-01881

ATLAS OF THE SPAWNING AND NURSERY AREAS OF GREAT LAKES FISHES; VOLUME XII, ST. LAWRENCE RIVER,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
For primary bibliographic entry see Field 7C.
W83-01882

COLUMBIA RIVER TREATY: ENVIRONMENTAL IMPACT,
Army Engineer Div. North Pacific, Portland, OR.
N. A. Dodge.
Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, Vol 108, No WR3, p 309-320, October, 1982. 9 Fig, 2 Ref.

Descriptors: *Environmental effects, *Hydroelectric power, *Fish conservation, Powerplants, *Columbia River Treaty, Canada, Treaties, International agreements, Social impact, Economic impact, Anadromous fish, Fish barriers, Fish guiding, Fish ladders, Fish management, Fish migration, Fish passages, Salmon, Dam effects, Reservoir storage, Reservoir operation, Reservoir releases, Flow augmentation, Instream flow, Recreation, Streamflow, Intakes, Minimum flow, Water storage, Water management, Benefits.

Implementation of the Columbia River Treaty (1961) has produced socioeconomic benefits and setbacks in the anadromous fishery. The treaty provides for cooperative basin management and sharing of power benefits between Canada and the U.S. Socioeconomic benefits include low-cost power, which stimulates the economy and encourages a high standard of living and reduction of major catastrophic floods. Power costs are mini-

mized by interconnecting the 16 Pacific Northwest utilities and the British Columbia Hydro and Power Authority. This coordination allows efficient use of streamflows. The filling of Mica Reservoir, initiated in 1973, was accomplished in minimum time by coordinating power generation and reservoir releases among utilities in the two countries. The salmon and steelhead fishery (current annual catch, 4-5 million fish) is low and declining. This is a result of ocean and river overfishing, poor forest and agricultural practices, elimination of headwater habitat, and dams on the river. Mitigation features include fish passages, propagation facilities, and hauling past the dam in trucks. Devices have been developed to reduce the number of juvenile fish entering the turbine intakes. A major remaining problem is the additional 15.5 million acre ft of storage developed after the Treaty. This causes reservoirs to hold back water for storage purposes, significantly reducing the spring freshet and discouraging migration to the sea. Minimum instream flow levels are proposed, but the agencies are having difficulty deciding on a program that will maintain flow without severely affecting the power system, irrigation, and recreational uses. Solutions to the problem (transmission to the Pacific Southwest in times of surplus and later retransmission and/or replacement of some power capacity with fossil fueled plants) are expensive. (Cassar-FRC)
W83-01909

ANALYSIS OF LONGITUDINAL ZONATIONATION AND THE RIVER CONTINUUM CONCEPT IN THE OLDMAN-SOUTH SASKATCHEWAN RIVER SYSTEM,
Calgary Univ. (Alberta). Dept. of Biology.
J. M. Culp, and R. W. Davies.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 39, No 9, p 1258-1266, September, 1982. 6 Fig, 4 Tab, 20 Ref.

Descriptors: *Zones, *Rivers, *Benthos, Macroinvertebrates, Forests, Prairies, Population dynamics, Watersheds, Geology, Climate, Soil type, Vegetation, Longitudinal zonation, River continuum concept, Reciprocal average ordination, *Alberta, Oldman-South Saskatchewan River system.

The benthic macroinvertebrate communities of the Oldman-South Saskatchewan River system demonstrated a longitudinal zonation related to the subalpine forest, fescue prairie, and mixed prairie terrestrial ecosystem during the summer-fall periods. This zonation was primarily attributable to significant downstream increases in periphyton biomass, plant nutrients, and water temperature. Zonation was reduced in the late winter-spring periods and absent in May, during spring runoff. Longitudinal trends in macroinvertebrate functional feeding groups generally followed the predictions of the river continuum concept, with trophic composition apparently more strongly affected by autotrophic processes in the summer, and heterotrophic processes in the winter. By combining the river continuum concept with a watershed classification system based on geology, climate, soil type, and terrestrial vegetation, it is suggested that biological comparisons of logitudinal zonation are enhanced. (Baker-FRC)
W83-02098

ECOLOGICAL RESPONSES OF HYDROPSYCHID CADDISFLIES TO STREAM REGULATION,
Montana Univ., Bigfork. Biological Station.
F. R. Hauer, and J. A. Stanford.
Canadian Journal of Fisheries and Aquatic Sciences, Vol 39, No 9, p 1235-1242, September, 1982. 4 Fig, 3 Tab, 31 Ref.

Descriptors: *Ecosystems, *Population dynamics, *Dams, Zoobenthos, Temperature effects, Particulate organic matter, Dissolved organic matter, Rivers, Hydropsychidae, Trichoptera, Flathead River, Stream continuum, Ecological effects, Montana, British Columbia.

Based on the river continuum theory and preliminary studies made in the upper Flathead River, it was expected that a sequential change would be noted in the hydropsychid fauna from large Arctopsychinae species in low-order streams to smaller Hydropsychinae in the higher-order rivers. Prior to the construction of Hungry Horse Dam, comparatively warmer waters and availability of sestonic particulate organic matter probably favored the smaller Hydropsychinae species over A. grandis in the mainstream river above Flathead Lake. However, cold-water discharges from Hungry Hose Dam, couples with increased concentrations of particulate organic matter from Kintla Creek, actually exerted a 'reset' influence on the Flathead River continuum by eliminating net-spinning caddisflies from the South Fork below the dam and significantly favoring A. grandis over the Hydropsychinae species in the mainstream. (Baker-FRC)
W83-02100

7. RESOURCES DATA

7A. Network Design

VERIFICATION PLAN FOR HYDROLOGIC DATA,
Geological Survey, Portland, OR. Water Resources Div.
C. W. Alexander.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $3.25 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 82-374, 1982. 22 p, 5 Fig, 3 Ref.

Descriptors: *Hydrologic data, *Computers, *Data processing, *Surface water, Streamflow, Data storage and retrieval, Error analysis, Quality control, Automation, Data verification.

Data verification refers to the performance of quality control on hydrologic data that have been retrieved from the field and are being prepared for dissemination to water-data users. Water-data users now have access to computerized data files containing unpublished, unverified hydrologic data. Therefore, it is necessary to develop techniques and systems whereby the computer can perform some data-verification functions before the data are stored in user-accessible files. Computerized data-verification routines can be developed for this purpose. A single, unified concept describing master data-verification program using multiple special-purpose subroutines, and a screen file containing verification criteria, can probably be adapted to any type and size of computer-processing system. Some traditional manual-verification procedures can be adapted for computerized verification, but new procedures can also be developed that would take advantage of the powerful statistical tools and data-handling procedures available to the computer. Prototype data-verification systems should be developed for all three data-processing environments as soon as possible. The WATSTORE system probably affords the greatest opportunity for long-range research and testing of new verification subroutines. (USGS)
W83-01855

AT-A-STATION HYDRAULIC GEOMETRY OF THE PLATTE RIVER IN SOUTH-CENTRAL NEBRASKA,
Geological Survey, Denver, CO. Water Resources Div.
T. R. Eschner.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver, CO 80225, Price: $8.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 82-436, 1982. 59 p, 21 Fig, 2 Tab, 36 Ref.

Descriptors: *Hydraulic geometry, *Channel morphology, *River flow, *Flow characteristics, Streamflow forecasting, Alluvial channels, Wildlife habitats, *Nebraska, Platte River.

At-a-station hydraulic-geometry of the Platte River in south-central Nebraska is complex. The range of exponents of simple power-function relations is large, both between different reaches of the river, and among different sections within a given reach. The at-a-station exponents plot in several fields of the b-f-m diagram, suggesting that morphologic and hydraulic changes with increasing discharge vary considerably. Systematic changes in the plotting positions of the exponents with time indicate that in general, the width exponent has decreased, although trends are not readily apparent in the other exponents. Plots of the hydraulic-geometry relations indicate that simple power functions are not the proper model in all instances. For these sections, breaks in the slopes of the hydraulic geometry relations serve to partition the data sets. Power functions fit separately to the partitioned data described the width-, depth-, and velocity-discharge relations more accurately than did a single power function. Plotting positions of the exponents from hydraulic geometry relations of partitioned data sets on b-f-m diagrams indicate that much of the apparent variations of plotting positions of single power functions results because the single power functions compromise both subsets of partitioned data. For several sections, the shape of the channel primarily accounts for the better fit of two-power functions to partitioned data than a single power function over the entire range of data. These non-log linear relations may have significance for channel maintenance. (USGS)
W83-01856

COST EFFECTIVE STREAM-GAGING STRATEGIES FOR MAINE,
Geological Survey, Augusta, ME. Water Resources Div.
R. A. Fontaine.
Available from the OFSS, USGS Box 25425, Fed. Ctr. Denver CO. 80225, Price: $6.00 in paper copy, $3.50 in microfiche. Geological Survey Open-File Report 82-507, July 1982. 43 p, 3 Fig, 6 Tab, 3 Ref.

Descriptors: *Cost analysis, *Data collections, *Networks, *Stream gages, Budgeting, Gaging stations, Hydrologic data, Hydrography, Backwater effect, Ice, *Maine.

This report documents the successful application of the traveling-hydrographer program developed by Moss and Gilroy to stream-gaging operations. This application was novel in the consideration of winter discharge records for the period of backwater effects due to ice. The current level of operation in Maine was identified as requiring a budget of $195,000 and having a total uncertainty of 374 cubic feet per second. Stream-gaging strategies were identified that could reduce the level of uncertainty in the system by as much as 45.8%, assuming the budgetary level remained constant. Alternately, practical stream-gaging strategies were also indentified that could reduce the total level of funding by as much as 19.2%, assuming the current level of uncertainty was deemed acceptable. Several alternatives of concurent budgeting and levels of uncertainty were identified. These relationships provide flexibility to the network manager. The results, documented in the report, were based on a sparse data base and should be applied in that context. (USGS)
W83-01857

7B. Data Acquisition

GEOPHYSICAL LOGGING SUPPLEMENTS TELEVISION INSPECTIONS,
Water Research Centre, Marlow (England).
K. Beesley.
Water Services, Vol 86, No 1038, p 379-380, August, 1982. 5 Fig, 1 Tab.

Descriptors: *Remote sensing, *Measuring instruments, *Maintenance, Wells, Television, Casings, Corrosion, *Geophysical logging, Acoustic televiewer, Caliper, Cement, Resistivity.

Television inspections of wells and boreholes alone are not always sufficient to reveal the exact nature of downhole problems. The selective use of geophysical logging techniques aids and clarifies the interpretation of television surveys. Logging techniques can 'see' where television cannot, such as behind casings and through dirty water. In addition, geophysical logging is often necessary when well construction records are poor or nonexistent. A tool called the acoustic televiewer enables sonic

pictures to be taken over the whole of the fluid filled section, and has the advantage of seeing through dirty water or mud. The tool is also fitted with orientation control. From the acoustic log the dip and orientation of the features can be determined, as the dimensions of the borehole are known from caliper logging. In the time needed to carry out the average television inspection of a borehole, several geophysical logs can be run. (Baker-FRC)
W83-01834

IMPROVED MICROAUTORADIOGRAPHIC METHOD TO DETERMINE INDIVIDUAL MICROORGANISMS ACTIVE IN SUBSTRATE UPTAKE IN NATURAL WATERS,
Naval Research Lab., Washington, DC.
For primary bibliographic entry see Field 5A.
W83-01993

7C. Evaluation, Processing and Publication

SPECIFIC CONDUCTANCE AND DISSOLVED CHLORIDE CONCENTRATIONS OF FRESH-WATER AQUIFERS AND STREAMS IN PETROLEUM PRODUCING AREAS IN MISSISSIPPI,
Geological Survey, Jackson, MS. Water Resources Div.
S. J. Kalkhoff.
Available from the OFSS, USGS Box 25425, Fed Ctr Denver, CO 80225. Paper copy $4.75, Microfiche $3.50. Geological Survey Open-File Report 82-353, 1982. 33 p, 6 Fig, 12 Tab, 12 Ref.

Descriptors: *Water quality, *Groundwater, *Surface water, *Specific conductivity, *Chlorides, Aquifers, Streams, Streamflow, Low flow, Water sampling, Sites, Wells, Oil fields, Brine disposal, Contamination, Data collections, *Mississippi.

Specific conductance and dissolved chloride reconnaissance sampling was conducted in six oil-producing areas of Mississippi during periods of low streamflow in 1980 and 1981. Water samples were collected at 224 ground-water and 190 suface-water sites. Samples from 55 surface-water and 17 ground-water sites contained dissolved chloride concentrations in excess of 100 milligrams per liter. All data collected are presented in tables without interpretation. (USGS)
W83-01851

QUALITY OF SURFACE WATERS IN WILTON, CONNECTICUT,
Geological Survey, Hartford, CT. Water Resources Div.
K. P. Kulp.
Available from the OFSS, USGS Box 25425, Fed Ctr, Denver, CO. 80225, Paper copy $7.00, Microfiche $3.50. Geological Survey Open-File Report 82-260, 1982. 51 p, 2 Fig, 11 Tab, 11 Ref.

Descriptors: *Water quality, *Data collections, *Surface water, *Streams, Sampling, Sites, Bottom sediments, Ecosystems, Aquatic bacteria, Aquatic life, Phytoplankton, Invertebrates, *Connecticut, Wilton.

Water, bed material, and biological samples were collected and analyzed at 10 surface-water gaging sites on six streams in the town of Wilton, Connecticut over a 2-year period. The data indicate fair to excellent water quality. Fecal coliform bacteria, pH, alkalinity, iron, and manganese are the parameters that most often exceed recommended limits established by either the U. S. Environmental Protection Agency or the Connecticut Department of Environmental Protection. Data from sites on the Norwalk and East Branch Silvermine Rivers indicate little if any undesirable changes in water quality take place as they flow through the study area. (USGS)
W83-01852

ESTIMATING THE MAGNITUDE OF PEAK DISCHARGES FOR SELECTED FLOOD FREQUENCIES ON SMALL STREAMS IN SOUTH CAROLINA (1975),
Geological Survey, Columbia, SC. Water Resources Div.
For primary bibliographic entry see Field 2E.
W83-01853

WATER RESOURCES DATA, WEST VIRGINIA, WATER YEAR 1981.
Geological Survey, Charleston, WV. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-148882, Price codes: A22 in paper copy, A01 in microfiche. Geological Survey Water-Data Report WV-81-1, 1982. 505 p, 5 Fig.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *West Virginia.

Water resources data for the 1981 water year for West Virginia consist of records of stage, discharge, and water quality of streams and springs; stage and contents of lakes and reservoirs; and water levels in wells. This report contains discharge records for 120 gaging stations, stage only records for 8 gaging stations, stage and contents for 8 lakes and reservoirs, contents for 1 reservoir, change in contents for 1 reservoir, water quality for 103 gaging stations, and water levels for 35 observation wells. Also included are 2 crest-stage partial-record stations, and 1 low-flow partial-record station. Additional water data were collected at various sites, not part of the systematic data-collections program, and are published as miscellaneous measurements and analyses. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in West Virginia. (USGS)
W83-01859

WATER RESOURCES DATA FOR PUERTO RICO, WATER YEARS 1979-80.
Geological Survey, San Juan, PR. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-159483. Geological Survey Water-Data Report PR-79-80, 1982. 408 p, 19 Fig, 2 Tab, 25 Ref.

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging Stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Puerto Rico.

Water-resources data for surface-water, quality-of-water, and ground-water records for 1979-80 water years for Puerto Rico consist of records of discharge, water quality of streams, and water levels of wells. This report contains discharge and water-quality records for 36 gaging stations, 109 water-quality stations, and water levels for 50 observation wells. Also included are data for 17 crest-stage partial-record stations. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and the Commonwealth of Puerto Rico. (USGS)
W83-01860

WATER RESOURCES DATA FOR OKLAHOMA, WATER YEAR 1980.
Geological Survey, Oklahoma City, OK. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB82-190356, Price codes: A12 in paper copy, A01 in microfiche. Geological Survey Water-Data Report OK-80-1, 1982. 613 p, 8 Fig,

Descriptors: *Hydrologic data, *Surface water, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Wells, Water level, Data collections, Sites, *Oklahoma.

Water resources data for the 1980 water year for Oklahoma consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes or reservoirs. This report contains discharge records for 138 gaging stations, stage and content for 25 lakes or reservoirs, water quality for 77 gaging stations and 3 lakes, and water levels for 43 wells. Also included are 44 crest-stage partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U. S. Geological Survey and cooperating State and Federal agencies in Oklahoma. (USGS)
W83-01862

ATLAS OF THE SPAWNING AND NURSERY AREAS OF GREAT LAKES FISHES; VOLUME I, SPAWNING AND NURSERY AREAS OF GREAT LAKES FISHES: A SUMMARY BY GEOGRAPHIC AREA,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
C. D. Goodyear, T. A. Edsall, D. M. O. Dempsey, G. D. Moss, and P. E. Polanski.
Report FWS/OBS-82/52, September 1982. 164 p, 82 Fig, 12 Tab. NCE-IS-78-30.

Descriptors: *Spawning, *Fish, *Aquatic habitats, *Distribution, *Great Lakes, Fish eggs, Fish nursery, Environmental effects, Spatial distribution, Tributaries, Littoral zone, Channels.

The information in this atlas of spawning and nursery areas may be used to support permit and project reviews, impact statement reviews, planning of baseline research, coordination with other agencies, and identification of data gaps. This volume was prepared to permit quick determination of whether a particular geographic area of interest in the Great Lakes or their connecting waters contains fish spawning or nursery areas that are identified in volumes II-XII of the atlas. Information is presented for each of the five Great Lakes by lake, by statistical fishing district within the lake and by geographic area within the statistical fishing district. Each geographic area includes about 20 miles of shoreline together with the adjacent littoral and offshore waters. Tables list the species or taxonomic groups that have spawning or nursery areas in each geographic area; indicate whether the areas are located in tributary, littoral, offshore, or navigation channel waters within the geographic area; list the spawning or nursery areas as confirmed, probable, or potential; and identify species whose continued existence was considered to be in jeopardy. Twenty-two taxonomic groups and 117 fish species are included in this study. (Moore-SRC)
W83-01871

ATLAS OF THE SPAWNING AND NURSERY AREAS OF GREAT LAKES FISHES; VOLUME II, LAKE SUPERIOR,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
C. D. Goodyear, T. A. Edsall, D. M. O. Dempsey, G. D. Moss, and P. E. Polanski.
Report FWS/OBS-82/52, September 1982. 122 p, 11 Fig. NCE-IS-78-30.

Descriptors: *Spawning, *Fish, *Distribution, *Aquatic habitats, *Lake Superior, Fish nursery, Spatial distribution, Great Lakes, Fish eggs, Larvae, Cisco, Trout, Salmon, Sculpin.

More than 60 species of fish have been recorded as residents of Lake Superior. This volume describes the reproductive habitat used by the 49 species for which information was available. Most of the 39 native species spawned in tributaries or in shallow, protected waters of the lake. Only six species, including the lake trout, lake herring, three species of ciscoes, and the fourhorn sculpin, utilized the deep offshore waters for spawning. Two of these deepwater spawners, the blackfin cisco and short-

nose cisco, are now believed to be extinct. Only the lake trout spawned in the tributaries, the shallow nearshore waters, and the deeper offshore waters. Five of the exotic species are salmonids which are believed to spawn exclusively in tributaries. Four spawn in tributaries and also in protected nearshore waters in some areas. Information on nursery areas is fragmentary, but it suggests that tributaries and nearshore waters are important as nursery areas, at least for the earliest life history stages. Dispersal from spawning areas is rapid for some species which have small, pelagic larvae, whereas the juveniles of salmonids that spawn in tributaries may remain in or near the spawning areas in those tributaries for as many as three years before entering the lake and dispersing. (Moore-SRC)
W83-01872

ATLAS OF THE SPAWNING AND NURSERY AREAS OF GREAT LAKES FISHES; VOLUME III, ST. MARY'S RIVER,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
C. D. Goodyear, T. A. Edsall, D. M. O. Dempsey, G. D. Moss, and P. E. Polanski.
Report FWS/OBS-82/52, September 1982. 29 p, 7 Fig. NCE-IS-78-30.

Descriptors: *Spawning, *Fish, *Distribution, *Aquatic habitats, *St. Marys River, Great Lakes, Fish nursery, Tributaries, Rapids, Bays, Fish eggs, Sturgeon, Trout, Salmon, Carp, Alewife, Pike, Smelt.

Historically, the St. Marys rapids were a major spawning area for lake sturgeon, lake whitefish, brook trout, and walleyes. The Canadian waters in the rapids area has a wider variety of substrate and provide more ideal spawning and nursery habitat than do the U. S. waters. Whitefish Channel contains relatively calm pools which are important reproductive habitat; the wetlands and extensive areas of shoals in the river also provide favorable reproductive habitat. Information was available on the reproductive habitat used by 35 of the 60 species of fish which have been recorded as residents or migrants. Most of the 27 native species spawned in tributaries to the river, in the shallow bays and shoreline areas, or in the St. Marys rapids. Sturgeon is the only species believed to spawn in deeper areas in the river channel. Four of the 8 exotic species are salmonids that spawn in the rapids or in tributaries. Smelt also spawn in tributaries; alewives and carp spawn in the protected bays. Information on nursery areas suggests that tributaries and nearshore waters, especially the bays, are important as nursery areas, at least for the earliest life history stages. Dispersal from spawning areas in rapid for some species which have small, pelagic larvae, whereas the juveniles of most salmonids that spawn in the rapids area or in tributaries may remain in or near those spawning areas for at least one year before dispersing. (Moore-SRC)
W83-01873

ATLAS OF THE SPAWNING AND NURSERY AREAS OF GREAT LAKES FISHES; VOLUME IV, LAKE MICHIGAN,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
C. D. Goodyear, T. A. Edsall, D. M. O. Dempsey, G. D. Moss, and P. E. Polanski.
Report FWS/OBS-82/52, September 1982. 209 p, 17 Fig. NCE-IS-78-30.

Descriptors: *Spawning, *Lake Michigan, *Aquatic habitats, *Distribution, *Fish, Great Lakes, Fish nursery, Fish eggs, Dam effects, Tributaries, Water pollution effects, Trout, Cisco, Sculpin, Salmon, Larvae.

Historically, large amounts of fish spawning habitat in Lake Michigan was destroyed or degraded by sawmill wastes, which covered spawning grounds in tributaries and near stream mouths, and by the construction of dams which blocked spawning migrations into tributaries. By the late 1800s, spawning grounds in Grand Traverse Bay and the Muskegon River had been degraded by sawdust. By the early 1900s, tthe Fox River was suitable for spawning because of the large number of dams and bottom deposits. Reproductive habitat is described for 64 species. Most of the 52 native species spawned in tributaries, reef areas, or in shallow, protected waters of the lake. Only the lake trout, seven species of ciscoes, and the fourhorn sculpin, utilized the deep offshore waters of spawning, and six of the ciscoes are believed to be extinct in Lake Michigan. Only the lake trout spawned in the shallow nearshore waters and also in deeper offshore waters. Six of the 12 exotic species are salmonids which spawn in tributaries; the other six exotic species spawn both in tributaries and in protected nearshore waters. Information suggests that tributaries and nearshore areas are important as nursery areas, at least for the earliest life stages. Dispersal from spawning areas is rapid for some species which have small, pelagic larvae, whereas the juveniles of some salmonids may remain in or near spawning areas in tributaries for as long as three years before entering the lake and dispersing. (Moore-SRC)
W83-01874

ATLAS OF THE SPAWNING AND NURSERY AREAS OF GREAT LAKES FISHES; VOLUME 5, LAKE HURON,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
C. D. Goodyear, T. A. Edsall, D. M. O. Dempsey, G. D. Moss, and P. E. Polanski.
Report FWS/OBS-82/52, September 1982. 121 p, 14 Fig. NCE-IS-78-30.

Descriptors: *Spawning, *Lake Huron, *Aquatic habitats, *Distribution, *Fish, Great Lakes, Larvae, Fish nursery, Fish eggs, Trout, Sculpin, Cisco, Salmon, Splake, Tributaries.

Almost 90 species of fish have been recorded as residents in Lake Huron. The reproductive habitat used by the 61 species for which information was available is described. Most of the 47 native species spawned in tributaries or in shallow, protected waters of the lake. Only the lake trout, five species of ciscoes, and the fourhorn sculpin, utilized the deep offshore water for spawning. Four of these deepwater spawners, the blackfin cisco, shortjaw cisco, deepwater cisco, and kiyi are now believed to be extinct in Lake Huron. Only the lake trout spawned in the swallow nearshore waters and also in the deeper offshore waters. Eight of the exotic species are salmonids which spawn in tributaries; the other six exotic species spawn in tributaries and also in protected nearshore waters in some areas. The splake, an artificial hybrid, apparently spawns in the nearshore waters. Tributaries and nearshore waters are important as nursery areas, at least for the earliest life stages. Dispersal from spawning areas is rapid for some species which have small, pelagic larvae, whereas the junveniles of some salmonids may remain in or near spawning areas in the tributaries for as long as three years before entering the lake and dispersing. (Moore-SRC)
W83-01875

ATLAS OF THE SPAWNING AND NURSERY AREAS OF GREAT LAKES FISHES; VOLUME VI, ST. CLAIR RIVER,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
C. D. Goodyear, T. A. Edsall, D. M. O. Dempsey, G. D. Moss, and P. E. Polanski.
Report FWS/OBS-82/52, September 1982, 25 p, 2 Fig. NCE-IS-78-30.

Descriptors: *Spawning, *Fish, *Aquatic habitats, *Distribution, *St. Clair River, *Fish migration, Great Lakes, Fish nursery, Fish eggs, Tributaries, Trout, Shad, Carp, Alewife, Sturgeon, Muskellunge, Larvae.

The St. Clair River, together with Lake St. Clair and the Detroit River, forms the connecting waterway between Lake Huron and Lake Erie. This waterway and its tributaries are important spawning and nursery areas for many species that support major fisheries in the waterway and in Lake Huron and Lake Erie. Almost 90 species of fish have been recorded as residents, or migrants, in the St. Clair River and its delta; of these, information was available on reproductive habitat for 28 species. Most of the 22 native species probably spawned in tributaries to the river or in shallow embayments and shoreline areas. Lake sturgeon and muskellunge are believed to be the only native species that spawned in the deeper areas of the river channel. Of the exotic species, rainbow trout spawn in the tributaries or along shore. Smelt also spawn in tributaries; alewives, carp and gizzard shad probably spawn in the tributaries and also in protected areas near shore. The river is an important migratory route for larvae which move through it in large numbers. Although the residence time of most larvae must be short because of the swift currents that prevail, the river must be considered an important nursery area. (Moore-SRC)
W83-01876

ATLAS OF THE SPAWNING AND NURSERY AREAS OF GREAT LAKES FISHES; VOLUME VII, LAKE ST. CLAIR,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
C. D. Goodyear, T. A. Edsall, D. M. O. Dempsey, G. D. Moss, and P. E. Polanski.
Report FWS/OBS-82/52, September 1982, 42 p, 13 Ref. NCE-IS-78-30.

Descriptors: *Spawning, *Fish, *Aquatic habitats, *Distributiom, *Lake St. Clair, Great Lakes, Fish nursery, Fish eggs, Muskellune, Shad, Carp, Wetlands, Tributaries, Fisheries.

Lake St. Clair forms part of the connecting waterway between Lake Huron and Lake Erie. The bays and wetlands of Lake St. Clair, especially in the St. Clair Flats area at the mouth of the St. Clair River, are important spawning and nursery areas for many species that support major fisheries in the waterway and in Lake Huron and Lake Erie. More than 70 species of fish have been recorded as residents, or migrants, in Lake St. Clair; reproductive habitat is provided for 34 species. Most of the 28 native species spawned in the shallow, productive St. Clair flats area, along shore, or in tributaries to the lake. Muskellunge may be the only native species that spawns in deeper areas of the lake. Of the six exotic species, smelt probably spawn in tributaries; alewives, gizzard shad, carp, and goldfish spawn in the bays and marshes of the Flats and in other shoreline areas. (Moore-SRC)
W83-01877

ATLAS OF THE SPAWNING AND NURSERY AREAS OF GREAT LAKES FISHES; VOLUME VIII, DETROIT RIVER,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
C. D. Goodyear, T. A. Edsall, D. M. O. Dempsey, G. D. Moss, and P. E. Polanski.
Report FWS/OBS-82/52, September 1982, 40 p, 9 Fig. NCE-IS-78-30.

Descriptors: *Spawning, *Fish, *Aquatic habitats, *Distribution, *Detroit River, *Fish migration, Great Lakes, Fish nursery, Fish eggs, Larvae, Smelt, Alewife, Shad, Carp, Tributaries.

The Detroit River, together with the St. Clair River and Lake Erie. This connecting waterway and its tributaries are important spawning and nursery areas for many species that support major fisheries in the waterway and in Lake Huron and Lake Erie. Twenty-seven of the 32 species for which reproductive habitat information is available are native to the Detroit river. Most of the islands in the lower portion of the river. Many of these areas in the lower river have been degraded. Of the exotic species, smelt spawn along island shorelines; alewives, gizzard shad, carp, and goldfish probably spawn in protected aeas near shore. The river is an important migration route for larvae which move through it in large numbers during the summer. Although the residence time of most larvae may be short because of the swift currents that prevail, the river must be considered an important nursery area. (Moore-SRC)
W83-01878

ATLAS OF THE SPAWNING AND NURSERY AREAS OF GREAT LAKES FISHES; VOLUME IX, LAKE ERIE,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
C. D. Goodyear, T. A. Edsall, D. M. O. Dempsey, G. D. Moss, and P. E. Polanski.
Report FWS/OBS-82/52, September 1982, 202 p, 25 Fig. NCE-IS-78-30.

Descriptors: *Spawning, *Fish, *Aquatic habitats, *Distribution, *Lake Erie, Great Lakes, Fish nursery, Fish eggs, Tributaries, Shiner, Salmon, Larvae.

Of the 91 species for which Lake Erie reproductve habitat information is available, 81 were native to the lake. Most of the native species spawned in tributatries or in shallow, protected waters of the lake. Only the emerald shiner utilizes the deep offshore waters, along with the nearshore waters, for spawning. Four of the ten exotic species are salmonids which spawn in tributaries; the other six spawn in tributaries and also in protected nearshore waters in some areas. Information on nursery areas used by the 91 species treated in this volume is fragmentary, but as would be expected, it suggests that tributaries and nearshore waters are important as nursery areas, at least for the earliest life stages. Dispersal from spawning areas is rapid for some species which have small, pelagic larvae, whereas the juveniles of some salmonids that spawn in tributaries may remain in or near spawning areas in those for as long as three years before entering the lake and dispersing. (Moore-SRC)
W83-01879

ATLAS OF THE SPAWNING AND NURSERY AREAS OF GREAT LAKES FISHES; VOLUME X, NIAGARA RIVER,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
C. D. Goodyear, T. A. Edsall, D. M. O. Dempsey, G. D. Moss, and P. E. Polanski.
Report FWS/OBS-82/52, September 1982, 22 p, 5 Fig. NCE-IS-78-30.

Descriptors: *Spawning, *Fish, *Aquatic habitats, *Distribution, *Niagara River, *Fish migration, Great Lakes, Fish nursery, Fish eggs, Trout, Smelt, Carp, Aquatic plants, Tributaries.

The Niagara River forms the connecting waterway between Lake Erie and Lake Ontario. Niagara Falls, approximately 15 mi downstream from Lake Erie, divides the river into upper and lower sections. Historically, narrow zones along each shore of the lower river supported rooted aquatic vegetation. In the upper river, extensive beds of aquatic macrophytes were present in the shallow bays and shoal areas around Grand Island. These weed beds were important areas of fish reproduction. Tributaries to the upper river also supported large spawning migrations in the spring and were important breeding areas. The abundance of young fish and low numbers of adults in the upper river indicated that the young fish moved out of the upper river and into Lake Erie. Almost 80 species of fish have been recorded as residents or migrants, and information on reproductive habitat was available for 24 species. Most of the 20 native species probably spawned in tributaries to the river or in the shallow embayments and shoreline areas, and around the islands in the upper river. Of the four exotic species, rainbow trout probably spawn in the tributaries and also in protected areas near shore. (Moore-SRC)
W83-01880

ATLAS OF THE SPAWNING AND NURSERY AREAS OF GREAT LAKES FISHES; VOLUME XI, LAKE ONTARIO,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
C. D. Goodyear, T. A. Edsall, D. M. O. Dempsey, G. D. Moss, and P. E. Polanski.
Report FWS/OBS-82/52, September 1982, 117 p, 19 Fig. NCE-IS-78-30.

Descriptors: *Spawning, *Fish, *Aquatic habitats, *Distribution, *Lake Ontario, Great Lakes, Fish nursery, Fish eggs, Larvae, Cisco, Trout, Herring, Sculpin, Tributaries.

More than 90 species of fish have been recorded as residents in Lake Ontario; reproductive habitat is described for the 67 species for which information is available. Most of the 55 native species spawned in tributaries or in shallow, protected waters of the lake. Only the lake trout, lake herring, four species of ciscoes, and the slimy sculpin utilized the deep offshore waters for spawning. Four of these deepwater spawners, the blackfin cisco, shortjaw cisco, deepwater cisco, and kiyi are now believed to be extinct in Lake Ontario. Lake trout and lake herring spawned in the shallow nearshore waters and also the deeper offshore waters. Six of the twelve exotic species are salmonids which spawn in tributaries. The other six exotic species spawn in tributaries and also in protected nearshore waters in some areas. Information on nursery areas used by these 67 species is fragmentary, but is suggests that tributaries and nearshore waters are important as nursery areas, at least for the earliest life stages. Dispersal from spawning areas is rapid for some species which have small, pelagic larvae, whereas the juveniles of some salmonids that spawn in tributaries may remain in or near spawning areas in those tributaries for as long as three years before dispersing. (Moore-SRC)
W83-01881

ATLAS OF THE SPAWNING AND NURSERY AREAS OF GREAT LAKES FISHES; VOLUME XII, ST. LAWRENCE RIVER,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
C. D. Goodyear, T. A. Edsall, D. M. O. Dempsey, G. D. Moss, and P. E. Polanski.
Report FWS/OBS-82/52, September 1982, 34 p, 3 Fig.

Descriptors: *Spawning, *Fish, Aquatic habitats, *Distribution, *St. Lawrence River, Great Lakes, Fish nursery, Fish eggs, Dam effects, Fish migration, Tributaries, Salmon, Smelt, Alewife, Carp.

The St. Lawrence River forms the connecting waterway between Lake Ontario and the Atlantic Ocean. Only the international section of the river is considered in this atlas. The important breeding habitats in the international section of the St. Lawrence River are in inshore areas, including the extensive wetlands and marshes, and the tributary streams. Historically, the tributaries (which warm earlier than the main stem of the river) were very important spawning grounds for many St. Lawrence fish species, which often run long distances upstream. Young fish remained in the creek mouths for some period of time before moving into the river. The habitats and migration patterns have been drastically altered by the extensive dam construction which has occurred on the river. In addition to the Moses-Saunders Dam on the main river at Cornwall, every major tributary is dammed within 20 mi of its mouth. The river mouths are still important spawning areas. Information on reproductive habitat is available for 45 of the more than 100 species of fish that have been recorded as residents or migrants. Most of the 40 native species probably spawned in tributaries to the river or in shallow embayments and shoreline areas, and around the islands in the upper river. Of the five exotic species, coho salmon probably spawn in the tributaries; alewives and carp probably spawn in the tributaries and also in protected areas near shore. (Moore-SRC)
W83-01882

ATLAS OF THE SPAWNING AND NURSERY AREAS OF GREAT LAKES FISHES; VOLUME XIII, REPRODUCTIVE CHARACTERISTICS OF GREAT LAKES FISHES,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
C. D. Goodyear, T. A. Edsall, D. M. O. Dempsey, G. D. Moss, and P. E. Polanski.
Report FWS/OBS-82/52, September 1982, 153 p. NCE-IS-78-30.

Descriptors: *Spawning, *Fish reproduction, *Aquatic haitats, *Distribution, *Great Lakes, Fish nursery, Fish eggs, Fish migration.

This volume presents concise descriptions of the reproductive characteristics and related spawning and nursery habitat requirements of each of the fish species included in Volumes I-XII of the atlas. These descriptions were compiled mainly from the information for Great Lakes populations presented in the other volumes. When additional information was needed to complete the descriptions, information was included for non-Great Lakes populations in the Province of Ontario and the eight states bordering the Great Lakes; in some instances information for populations outside the Great Lakes region was included. The following information is included for each of the 116 species: prespawning and postspawning migration of adults; spawning season, site, substrate and water depth; incubation and hatching duration and site; distribution and movement of young. (Moore-SRC)
W83-01883

SIMPLIFIED TESTING OF HYDROLOGIC REGRESSION REGIONS,
Geological Survey, Reston, VA.
G. D. Tasker.
Journal of the Hydraulics Divsion, Proceedings of the the American Society of Civil Engineers, Vol 108, No HY10, p 1218-1222, October, 1982. 1 Tab, 5 Ref.

Descriptors: *Regression analysis, *Cluster analysis, *Hydrologic models, *Rainfall-runoff relationships, Error analysis, *Minnesota, Gaging stations, Statistical analysis, Wilcoxon Signed Ranks Test, Data processing, Mathematics.

Hydrologists using regional regression models to transfer information from gaged sites to improve estimates at gaged sites or create data for ungaged sites often subjectively divide the residuals into similar clusters on a map. The Wilcoxon Signed Ranks Test is proposed for testing the statistical significance of such clusters of regression residuals. It assumes each residual in a region to be a continuous random variable from a symmetric distribution with mean of zero. Residuals are mutually independent. The procedure is applied to data from 84 small drainage area stations in Minnesota to estimate parameters of log linear regression of 2-year peak discharges. (Cassar-FRC)
W83-01922

8. ENGINEERING WORKS

8A. Structures

MUDFLOW DETENTION DAM AT MYNZHILKI,
Yu. N. Zinevich.
Hydrotechnical Construction, Vol 15, No 12, p 762-767, December 1981. 2 Fig, 6 Ref, Translated from Gidrotekhnicheskoe Stroitel'stvo, No 12, p 33-35, December 1981.

Descriptors: *Dams, *Mudflows, *Glaciers, Mynzhilki Dam, *USSR, Little Almatinka River, River basins, Construction.

Little Almatinka is one of the most mudflow-active rivers in the Soviet Union, with catastrophic mudflows causing considerable damage to the city nearby. Headwaters for the river are located in the glacial zone at 3500 m. Here are located 12 glaciers with a total of 11.4 sq km and several glacial lakes which fill to overflowing in the summer melt period. In 1978 the design of a new Mynzhilki mudflow detention dam was completed. The side of the dam closes the trough valley of the same name and is located at a distance of 1.5 km from the river headwaters at a height of 3010 m. The dam is intended to prevent the formation of mudflows of the glacial type. The Medeo detention dam is complemented by the second dam, in that the former one is designed to control the main part of the basin of the Little Almatinka with its numerous mudflow-danger tributaries and the Mynzhilki dam controls only the upper reaches of the main channel of the Little Almatinka. The structures of the Mynzhilki mudflow detention dam include an earth dam of boulders and gravel, an automatic

outlet, and an emergency catastrophic spillway. (Baker-FRC)
W83-01767

CONVERTING AN ESTUARY TO LAKE GREVELINGEN: ENVIRONMENTAL REVIEW OF A COASTAL ENGINEERING PROJECT,
Ministry of Transport and Public Works, Middelburg (Netherlands). Environmental Research Div.
For primary bibliographic entry see Field 6G.
W83-01784

PHASE II INSPECTION OF LAKE MANATEE DAM,
Bromwell Engineering, Inc., Lakeland, FL.
W. D. Carrier, III, B. Keshian, Jr., and L. G. Bromwell.
Journal of the Geotechnical Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No GT10, p 1273-1287, October, 1982. 9 Fig, 2 Tab, 8 Ref.

Descriptors: *Dam stability, *Spillways, *Seepage control, Inspection, Earth dams, Lake Manatee Dam, *Florida, Reservoir operation, Drains, Design criteria, Embankments, Slope stability, Stability analysis.

Lake Manatee Dam, constructed during 1965-67, supplies water for 250,000 people in the Bradenton-Sarasota area of Florida. It is composed of 3 earthen zones (inner clay core and 2 outer layers of sand and silty sand). The dam is 5000 ft long, with a crest elevation of 50-52 ft and a 100 ft long spillway. During the Phase I inspection in 1978 two major problems were revealed: a spillway capacity inadequate for a major storm and inadequate seepage controls. The dam was classified as large with a high hazard potential. Construction of an emergency spillway was recommended. Phase II inspection, May-October 1979, was extensive because much design and construction data were missing. This investigation indicated that the embankment has a satisfactory factor of safety (minimum, 2) against slope failure, and the concrete spillway has a satisfactory factor of safety (4) against overturning. The toe drain, not constructed in accordance with drawings and specifications, was partially clogged by the fine fraction in the inner gravel filter. It was recommended that a new toe drain be installed, using filter cloth and clean durable gravel. The recommended design also specified that the toe drain be extended further up the abutments to intercept seepage. A step-by-step procedure was developed to operate the spillway in case of a 100 year storm (16,000 cfs). To handle the probable maximum flood (67,000 cfs) construction of an emergency spillway was suggested. A detailed instrument reading schedule was given for monitoring drain performance, settlement, and slope stability.
W83-01917

OPTIMAL DESIGN OF STILLING BASINS FOR OVERFLOW SPILLWAYS,
Nevada Univ., Reno. Dept. of Civil Engineering.
Y. K. Tung, and L. W. Mays.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 108, No HY10, p 1163-1178, October, 1982. 9 Fig, 5 Tab, 7 Ref.

Descriptors: *Stilling basins, *Dam design, *Hydraulic jump, Optimization, Model studies, Spillways, Overflow, Design criteria, Hydraulic structures, *Texas, Energy dissipation, Baffles.

A model is given for determination of the optimum floor elevation and basin width and corresponding dimensions of appurtenances for stilling basins for overflow dam spillways. The procedure is divided into two phases to determine: (1) the appropriate combination of spilling basin width and elevation to satisfy hydraulic performance requirements, and (2) the minimum-cost design which satisfies required performance. The procedure is applied to stilling basins of three existing dams in Texas, Rockwall-Forney, Conroe, and Twinbutts. The Conroe and Twinbutts stilling basins are conservatively designed to prevent downstream scoring. Rockwall's hydraulic jump would sweep out of the basin at discharges exceeding 230,000 cfs. Conroe's actual design is close to the optimum as determined by the model. In practice, an optimization model is useful in preliminary planning. Scale model studies are generally necessary to develop a final design. (Cassar-FRC)
W83-01918

OPTIMUM PROFILES OF GRAVITY DAMS,
C. S. Joshi.
International Water Power and Dam Construction, Vol 34, No 9, p 35-36, September, 1982. 4 Fig.

Descriptors: *Gravity dams, *Design criteria, *Slopes, Construction, Engineering, Tension, *Optimization.

Arguments in favor of adopting two downstream slopes for a gravity dam profile are considered. While substantial savings result for dams in the height range of 50-70 m, even for dams of heights about 30 m there are savings to be realized. Two design considerations which should be met are: the upstream heel should not develop any tension for any of the combinations of loads when the reservoir is either at full supply level or at maximum flood water level; and the downstream toe should not develop any tension for any of the load combinations during construction, such as when the reservoir is empty or when the water level is at its minimum. From about 10 profiles designed using the method described in the article of dams ranging between 30 and 70 m high, it is noted that the second slope needs to be started at about 14 m to 24 m below the water surface, a lower value for lower design head and higher value for higher design head; the rate of change in the value of the second slope needed goes on decreasing as the design water head increases and the increase becomes very small for dams exceeding 90 m in height to satisfy the condition of no tension on the upstream heel; for the same design head and with different points of starting of the second downstream slope, the profile with the least cross-sectional area develops the least downstream normal stress. (Baker-FRC)
W83-02082

8B. Hydraulics

ASYMMETRIC FLOW IN SYMMETRIC EXPANSIONS,
S. D. Graber.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 108, No HY10, p 1082-1101, October 1982, 11 Fig, 18 Ref.

Descriptors: *Channel flow, *Flow patterns, *Deflection, Asymmetric flow, Flow expansion, Hydraulic profiles, Vortices, Vanes, Scour, Channel scour, Stability analysis.

Asymmetrical flow patterns, usually detrimental in channels and pumping plants, may occur in symmetrical abrupt expansions, where the main flow deflects and attaches to one wall of the expansion. The adverse effects include lengthening the distance to full-width flow in expansions, scour of downstream channel banks, inefficient operation of screens in screen channels, and increasing the potential for vortexing in pump intakes. The asymmetric behavior is attributed to a static instability of the system occurring under certain conditions of expansion geometry. Forces acting on the system when it undergoes a small deflection from the symmetric position are analyzed. The deflection causes a destabilizing pressure differential opposed by a stabilizing momentum reaction that tends to restore the system to its position of symmetry. The stability of the system depends on the variation of these competing forces during small deflections. Stability results if the change in the stabilizing momentum reaction exceeds the change in the destabilizing pressure force. If not, an asymmetric flow pattern occurs. A mathematical stability criterion is developed and applied to subcritical, horizontal, rectangular expansions. Results agree well with experimental observations in published literature. Measures to prevent and correct undesirable asymmetric flow in sudden expansions include communication between the eddy regions with a pipe or addition of a vane parallel to, and in the center of, the flow, extending from the plane of separation to the plane of reattachment. (Cassar-FRC)
W83-01887

MODEL STUDY OF LOW DROP GRADE CONTROL STRUCTURES,
Science and Education Administration, Oxford, MS. Sedimentation Lab.
W. C. Little, and J. B. Murphey.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 108, No HY10, p 1132-1146, October 1982, 9 Fig, 3 Tab, 7 Ref.

Descriptors: *Erosion control, *Overfalls, *Stilling basins, Design criteria, Hydraulics, Bank erosion, Channel erosion, Hydraulic jump, Alluvial channels, Scour, Channel scour, Baffles, Energy loss, Low drop structures, *Mississippi, *Arkansas.

Low drop grade control structures were objected to model studies for the purpose of designing structures for the purpose of designing structures for installation in creeks in Mississippi and Arkansas. These structures control the severe channel degradation seen in alluvial valley streams in which headcuts or overfalls of 0.3-1.5 m in height progress upstream, causing bed scour, bank slumps and slides, and channel widening. Low drop is defined as a hydraulic drop with a relative drop height equal to or less than 1; a high drop has a similar value of greater than 1. The relative drop height is defined as the difference in elevation between upstream and downstream channel beds divided by the critical depth. Using a model basin, tentative design criteria were developed for stilling basins for low drops with energy dissipation devices. A method is also given to determine the size and placement of a baffle pier or plate to obtain optimum flow conditions downstream. (Cassar-FRC)
W83-01888

TIME SCALE FOR SCOUR DOWNSTREAM OF HYDRAULIC JUMP,
J. Farhoudi, and K. V. H. Smith.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 108, No HY10, p 1147-1162, October 1982.

Descriptors: *Scour, *Hydraulic jump, Energy dissipation, Hydraulic properties, Erosion, *Timing, Estuaries.

The time scale of scour development downstream from a hydraulic structure is very important in the case of rivers with short duration peak flows. This paper discusses Breusers' work on scour downstream of estuary closure structures and extends it to the case of local scour downstream of a hydraulic jump. Experiments were conducted in small, medium, and large flumes with bed materials of particle sizes 0.25 and 0.52 mm (bakelite) and 0.15-0.85 mm (sand). The relationship between maximum scour depth and time of scour depth and time of scour development was of the same form for the hydraulic jump and for the Breusers estuary closure structure. However, the value of the exponent, alpha, was different. A prototype problem investigated scour resulting from a plunge-type energy dissipator which had an overflow weir expected to overflow infrequently and for a short period. The 1/12 scale model also had 1/12 scale in time to scour development, that is, 1 min of model time to scour represented 12 min of prototype time to scour. This relationship can be used to calculate time to scour from a model for prototypes or models of different sizes. (Cassar-FRC)
W83-01889

EQUIVALENT ROUGHNESS OF ALLUVIAL BED,
Waterloopkundig Lab., Delft (Netherlands).
L. C. van Rijn.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 108,

No HY10, p 1215-1218, October, 1982. 2 Fig, 13 Ref.

Descriptors: *Hydraulic roughness, *Flow resistance, *Bed sediment, Alluvial channels, Sediment transport, River beds, Channel flow, Streamflow.

A relationship between the dimensions of the bed forms and their effective roughness is developed for flow conditions with a movable bed or movable bed forms. The effective roughness of a plane movable bed varied from about 1 to 10 D90 of the bed material and was not dependent on transport stage. The effective roughness of the bed forms depended on the height/steepness ratio of the movable bed forms. (Cassar-FRC)
W83-01923

RECOVERY IN LARGE DIAMETER WELLS,
Center for Water Resources Development and Management, Calicut (India). Ground Water Div.
P. Basak.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 108, No HY10, p 1194-1207, October, 1982. 7 Fig, 2 Tab, 5 Ref.

Descriptors: *Drawdown, *Open wells, *Groundwater movement, Well yield, Shallow wells, Fully penetrating wells, India, Dug wells, Confined aquifers.

A closed-form approximate analytical solution for recovery in fully-penetrating large diameter wells tapping a confined aquifer was developed. Transient recovery responded logarithmically with time, inflow rate decreased exponentially with time, and cumulative recovery increased asymptotically with time. Predictions agreed very well with field data from 6 wells, 4-7 m deep and 1-3 m in radius, dug in a variety of soils: fractured rocks, laterite, and alluvial sand. Solutions are also valid for unconfined flow conditions under small drawdown at all times and under larger initial drawdown at later times. (Cassar-FRC)
W83-01924

TABULAR REPRESENTATION OF CROSS-SECTIONAL ELEMENTS,
Linsley, Kraeger Associates Ltd., Mountain View, CA.
D. D. Franz.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 108, No HY10, p 1070-1081, October, 1982. 1 Fig, 4 Tab, 7 Ref.

Descriptors: *Error analysis, *Cross-sections, *Tables, Streams, Channel morphology, Hydraulics.

A table of values and rules for interpolation are presented for defining consistent values for the cross-sectional elements of top width, area, first moment of area, and second moment of area for an irregular stream cross section. The variation of the top width is taken to be piecewise linear and continuous. The top width is then integrated exactly to obtain the values for the other elements. Integration is also used in interpolation. Values obtained with this procedure are consistent with the mathematical definition of the elements. In an example, errors from operational assumptions and from the basic top width data are estimated separately. The operational error is much smaller than the inherent error at larger depths and of the same order at smaller depths. (Cassar-FRC)
W83-01926

SHORE LINE EFFECTS ON MIXING OF TEE DIFFUSER,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
E. E. Adams, W. C. Skamarock, and R. U. Nothaft.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol 108, No HY10, p 1232-1238, October, 1982. 2 Fig, 7 Ref.

Descriptors: *Mixing, *Thermal pollution, Heated water, Shallow water, Shores, Fate of pollutants, Dilution, *Diffusers, *Tee diffuser.

A semi-empirical theory for a shallow water tee diffuser in quiescent water of large horizontal extent is modified to include the effects of shore line proximity. The theory was tested on a laboratory model. To obtain dilution equal to 90% or better of that predicted for an unconfined water body, the distance between the diffuser and the shore must be at least 80% of the diffuser length. For 70% of the dilution, the separation distance may be as little as 35% of the diffuser length. The results assume a constant receiving water depth. For a sloping bottom, the distance between diffuser and shore is divided by 2 for use in the equation. (Cassar-FRC)
W83-01928

NUMERICALLY COMPUTED MULTIPLE STEADY STATES OF VERTICAL BUOYANCY-INDUCED FLOWS IN COLD PURE WATER,
State Univ. of New York at Buffalo, Amherst. Dept. of Mathematics.
I. El-Henawy, B. Hassard, N. Kazarinoff, B. Gebhart, and J. Mollendorf.
Journal of Fluid Mechanics, Vol 122, p 235-250, 1982. 10 Fig, 2 Tab, 22 Ref.

Descriptors: *Buoyancy, *Flow, Hydrodynamics, Fluid mechanics, Velocity, Temperature effects, Laminar flow, Surface flow.

The laminar, boundary-layer, natural convection flow adjacent to a vertical, heated or cooled, flat surface submerged in quiescent cold water was studied. The results demonstrate for the first time the existence of multiple steady-state solutions in a natural convection flow. The calculated velocity profiles over a range of the parameters are compared with recent corresponding velocity measurements. The newly found additional steady-state solutions are of considerable practical interest because the heat-transfer rates for a pair of solutions (with determining physical parameters and boundary conditions otherwise identical) are sometimes vastly different. An important consequence of this study is the possible relationship of multiple steady-state solutions to the recently observed unsteadiness in some such flows. (Baker-FRC)
W83-01989

ON THE STRUCTURE OF TURBULENT CHANNEL FLOW,
Royal Inst. of Tech., Stockholm (Sweden). Dept. of Mechanics.
A. V. Johansson, and P. H. Alfredson.
Journal of Fluid Mechanics, Vol 122, p 295-314, 1982. 16 Fig, 1 Tab, 24 Ref.

Descriptors: *Channels, *Surface flow, *Turbulence, Flow, Hydrodynamics, Reynolds numbers, Stream flow, VITA technique.

Hot-film measurements of the streamwise velocity component were carried out in a fully developed turbulent water channel flow for three different Reynolds numbers (13800, 34600, and 48900). The results for the first four statistical moments complement and extend the results from previous studies of turbulent channel flow. The VITA variance technique was used to detect deterministic events in the streamwise velocity. It was demonstrated that the VITA technique has a band-pass-filter character. The number of events detected was found to decrease exponentially with the threshold level, and the events occupy a wide range of timescales. This makes it impossible to define one unique frequency of occurrence or one unique duration of the events. However, by using this technique information was obtained on the amplitude and timescale distributions of the events. The characteristic features of the conditional averages were related to the skewness and flatness factors. (Baker-FRC)
W83-01990

BOUYANCY-DRIVEN CIRCULATION IN FREE-SURFACE CHANNELS,
Iowa Univ., Iowa City. Inst. of Hydraulic Research.
S. C. Jain.
Journal of Fluid Mechanics, Vol 122, p 1-12, 1982. 7 Fig, 9 Ref.

Descriptors: *Channels, *Water circulation, Flux, Buoyancy, Temperature effects, Velocity, Flow, Mathematical equations, Heat loss, Surface flow, Hydrodynamics.

The convective circulation driven by a surface buoyancy flux in a dead-end open channel is analyzed. Making the assumption of similarity profiles for velocity and temperature, the governing partial differentials are reduced to two nonlinear ordinary differential equations by integrating over the flow depth. A closed-form solution of the differential equations is presented. The solution is a function of the Grashof number G and the modified Prandtl-Grashof number PmG1/2. The velocity and temperature along the channel vary linearly as the distance and as the square of the distance respectively. Analytical expressions for the rate of total heat loss from the channel and the rate of flow in the channel are derived. The analytical results compare well with the available experimental data. (Baker-FRC)
W83-01991

SELF-SIMILAR PARTICLE-SIZE DISTRIBUTIONS DURING COAGULATION: THEORY AND EXPERIMENTAL VERIFICATION,
California Univ., Berkeley. Div. of Sanitary, Environmental, Coastal, and Hydraulic Engineering.
J. R. Hunt.
Journal of Fluid Mechanics, Vol 122, p 169-185, 1982. 7 Fig, 34 Ref.

Descriptors: *Coagulation, *Particulate matter, Estuaries, Coastal waters, Kinetics, Brownian motion, Fluid mechanics, Hydrodynamics, Particle size, Hydraulic engineering, Suspended solids, Sedimentation.

A quantitative theory for particle coagulation in continuous particle size distributions is presented and experimentally verified. The analysis, flowing Friedlander, assumes a local equilibrium in the size distribution maintained by a particle flux through the size distribution. Only particle collisions caused by Brownian motion, fluid shear and differences in settling velocities are considered. For intervals of particle size where only one coagulation mechanism is dominant, dimensional analysis predicts self-similar size distributions that contain only one dimensionless constant for each mechanism. Experiments were designed to test these predictions with clay particles in artificial seawater sheared in the gap between concentric rotating cylinders. Particle-size distributions measured over time were self-similar in shape and agreed with the Brownian- and shear-coagulation prediction in terms of shape and dependence on fluid shear rate and particle volume flux through the size distribution. (Baker-FRC)
W83-01992

ICE PRESSURE ON A VERTICAL SUPPORT (DISCUSSION OF CONSTRUCTION SPECIFICATIONS),
N. G. Khrapatyi.
Hydrotechnical Construction, Vol 15, No 12, p 775-779, December, 1981. 3 Fig, 4 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 12, p 40-42, December, 1981.

Descriptors: *Ice pressure, *Dams, *Design criteria, *Construction specifications, Ice, Ice Jams, Ice cover, Ice thickness, Engineering.

The design pressure at the contact of ice with a vertical structure is determined by the ratio of the value of the ice load to the area of contact and is assumed equal to the uniaxial compressive strength of an ice sample, corrected by coefficients for the local crushing of the ice shape of the support and the density of the contact. Experimental results of measuring the ice load (the contact pressure) show that there are substantial differences in the case of this interaction of rectangular or round supports of

hydraulic structures with the ice cover. This is especially noticeable in the case of indentation and penetration of ice by the supports. An examination is reported of the process of loading the edge of the ice cover at a separately standing vertical support when D/H is less than one (D being the diameter of the support and H the thickness of the ice), when the contact pressure exceeds the elastic limit of ice. The relationship of the effect of the ratio D/H to the contact strength of the ice cover was determined. (Baker-FRC)
W83-02086

8C. Hydraulic Machinery

ADDING A FIFTH UNIT TO IDAHO'S BROWNLEE DAM,
International Engineering Co., Inc., San Francisco, CA. Water Resources Div.
For primary bibliographic entry see Field 8E.
W83-01846

SAVINGS FLOW FROM PUMPS USED AS TURBINES.
Journal of the American Water Works Association, Vol 74, No 10, p 27, 30, 32, October, 1982. 3 Fig.

Descriptors: *Electric power production, *Hydroelectric power, *Turbines, *Hydraulic turbines, *Pump turbines, *Performance evaluation, Electric power costs, Electric powerplants, Pumps, Hydraulic machinery, Hydraulic equipment, *New York City.

The Bureau of Water Supply of the city of New York has saved thousands of dollars in electricity costs by running two large pumps as turbines and capturing hydropower to supply water to the Delaware Aqueduct. The Delaware Aqueduct carries water from more distant higher altitude sources than the older Croton Reservoir network. The greater pressure can gravity-feed higher elevations of New York City. After thirty years, the pump still functions well, with almost no maintenance. The cost of running the pumps compared with electrical pumps is almost nil. Various government and private firms are studying use of water to drive hydraulic turbines in view of rising electrical costs. Many pumps have been tested as turbines. As such, the head and flow of their best efficiency point (BEP) are higher than the pump input power at its BEP. When pumps operate as turbines, the maximum efficiences occur over a wide range of capabilities, and there is a value of head at which the turbine power output is zero even though there is flow through the unit. Cavitation can occur in turbines, just as in pumps, but may be prevented by maintaining sufficient outlet or back pressure. Before operating a pump as a turbine, a review of its design should include checking that threaded shaft components cannot loosen, evaluating the bearings, analyzing shaft stress, and checking the effect of increased pressure forces. For low-head applications, it is important to minimize the remaining energy after exit from the runner to maintain high efficiency. (Geiger-FRC)
W83-02030

MECHANICAL EQUIPMENT OF THE DEWATERING OUTLETS OF THE INGURI ARCH DAM,
I. F. Kochanov, and S. V. Farmakovskii.
Hydrotechnical Construction, Vol 15, No 12, p 729-739, December, 1981. 10 Fig, Translated from Gidrotekhnicheskoe Stroitel'stvo, No 12, p 13-19, December, 1981.

Descriptors: *Arch dams, *Dewatering outlets, *Mechanical equipment, Equipment, Engineering, Construction, Dams, Gates, Conduits, *USSR, Inguni arch dam.

The mechanical equipment of the dewatering outlets of the Inguri hydroelectric station was designed to absorb the static head and regulate the waste discharges at heads up to 181 m, and is unparalleled in design in Soviet and foreign construction practice. This equipment made it possible to dispense with the second level of outlets, whic provided considerable cost savings. The dewatering outlets, lined with metal and of round cross section for minimum weakening of the dam profile, are intended for diversion during filling of the reservoir, discharge of floodwaters, and drawdown of the reservoir. The mechanical equipment of the dewatering outlets icluded: a guard gate with embedded parts and a rod; bell-mouths with a diameter of 8.2/5 m; metal (regulating) gates; housings of the emergency-guard ring-follower gates; service (regulating) gates; housings of the emergency-guard gates and service gates; hydraulic drives of these gates; a 100/20-ton-capacity bridge crane; and other equipment. It was recently decided to install special flat crescent-shaped diaphragms in the exit sections of the outlets. The resulting design discharge of the outlets will be 465 cu m/sec each. (Baker-FRC)
W83-02087

8D. Soil Mechanics

PERCENTAGE SILT CONTENT IN SANDS AND ITS EFFECT ON LIQUEFACTION POTENTIAL,
Water and Power Resources Service, Denver, CO. Engineering and Research Center.
L. P. Kaufman.
Report, Decebember 1981, 171 p, 74 Fig, 8 Tab, 78 Ref. (M. S. Thesis, 1981, University of Colorado, Boulder, Dept. of Civil and Urban Engineering).

Descriptors: *Earthquakes, *Silt, *Sand, Liquefaction, *Soil dynamics, Soil physics, Cohesionless soils, Particle size, Uniformity coefficient.

The immense damage caused by soil liquefaction during earthquakes in 1964 greatly stimulated geotechnical engineers toward systematic studies of the phenomenon of earthquake-induced liquefaction of cohesionless soil deposits. The problem of the liquefaction potential of soils must also be taken into consideration in the design of earth embankment dams, mine tailings dams, nuclear power plants, bridge supports, waterfront structures, and large offshore structures. The liquefaction potential of reconstituted soil specimens was determined using the cyclic triaxial test. Four sand samples were prepared which differed from each other in respect to mean grain size and coefficients of uniformity. Measured portions of silt were mixed with each sand sample to result in test samples containing 10, 30, 60 and 100% silt. The results of the cyclic triaxial tests reveal that the liquefaction potential of those soil samples varies systematically and predictably. An increase in silt content is found to strengthen the sandy soil. The mean grain size and the coefficient of uniformity of the original sand samples appeared to have little or no effect on the cyclic shear resistance of the silty samples which were derived from them. (Moore-SRC)
W83-01885

SEISMIC RESPONSE OF EARTH DAMS IN TRIANGULAR CANYONS,
F. I. Makdisi, T. Kagawa, and H. B. Seed.
Journal of the Geotechnical Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No GT10, p 1328-1337, October 1982, 11 Fig, 8 Ref.

Descriptors: *Dam stability, *Seismic properties, *Vibrations, *Earth dams, *Canyons, Embankments, Plane strain analysis, Strain measurement, Shear stress, Soil mechanics, Geophysics.

The effects of narrow and sloping canyons on the seismic response of embankment dams was studied using three-dimensional dynamic finite element analysis. Both triangular and rectangular canyon cross sections were considered. The results for several embankment width to height ratios were compared with plane strain solutions, and large differences were found between the two solutions. The natural frequencies for horizontal soil deposits in triangular sections with width to height ratios up to 5 were 40% higher than those computed from one-dimensional column studies. In deposits with a width to height ratio of 5 in rectangular canyons, the natural frequencies were within 5% of the one-dimensional solution. For embankments in triangular canyons the computed natural frequencies from three-dimensional analysis were 35% higher than those of plane strain solutions even for width to height ratios of 6 or more. For embankments with width to height ratios of 3 subjected to transient ground motions, the computed accelerations for the three-dimensional solution at the midsection were 60-80% higher than those of the plane strain response; computed shear stresses were half those of the plane strain analysis. Smaller differences were found at the quarter section, depending on the height of the embankment, width of the canyon, and frequency content of the input base motion. Three-dimensional analysis was more useful and accurate than the plane strain assumption in predicting response of dams built in narrow and steep triangular canyons. (Cassar-FRC)
W83-01890

FILTER CRITERIA FOR GEOTEXTILE: RELEVANCE AND USE,
Lawson Consulting, Sydney (Australia).
C. R. Lawson.
Journal of the Geotechnical Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No GT10, p 1300-1317, October, 1982. 13 Fig, 1 Tab, 23 Ref.

Descriptors: *Soil filters, *Textiles, *Dam design, Geofilters, Filters, Construction materials, Soil water, Materials testing, Soil piping, Permeability, Uniformity coefficient, Subsurface drainage, Drainage, Pore size, Particle size, Hydraulic properties.

A laboratory evaluation program established that existing geofilter criteria were valid in the case of an earthfill dam constructed on fly ash base where applied water heads at the ash-geotextile suface were large (up to 10.8 m). For optimal filter performance in one-directional filter applications two criteria must be met. After an initial period of instability during which formation of the soil filter occurs, the permeability of the system should remain constant, and no further in situ soil should be piped through the filter system. Several sets of criteria, consisting of empirical relationships have been developed to evaluate a system. Most are concerned with piping, permeability, uniformity, pore size of the geotextile and/or soil particle size. Results of different methods are in general agreement on the choice of the preferred geotextile. A geotextile's mechanical properties must also be considered so that rupture does not occur during installation or during the service life of the structure. (Cassar-FRC)
W83-01930

SHALLOW FOUNDATIONS IN COLD REGIONS: DESIGN,
Hardy Associates Ltd., Edmonton (Alberta).
E. C. McRoberts.
Journal of the Geotechnical Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 108, No GT10, p 1338-1349, October, 1982. 5 Fig, 31 Ref.

Descriptors: *Foundation, *Cold weather construction, *Design criteria, Soil mechanics, Construction, Frozen ground, *Reviews, Geothermal studies, Thaw, Structural settlement, Creep, Ice, Adfreezing, *Permafrost, Frost heaving, Frost protection.

A review of the North American literature concerning techniques for design of shallow foundations in permafrost considers geothermal aspects, thaw settlement and consolidation effects, frost heaving, and frozen ground aspects. The purpose of this paper is to overview the major factors to consider in design and provide a bibliography as a source of further information. The builder must consider the degree of frost in the region: seasonal frost, discontinuous permafrost, or continuous permafrost. Several analytical methods are available for studying conduction, the dominant mode of

heat transfer. Testing techniques for thaw settlement and thaw consolidation are available. Three basic approaches in design of shallow foundations for frost heave are: (1) prevention by a geothermal design that inhibits frost penetration, (2) prediction by empirical techniques to ensure that the structure can tolerate the probable heave, and (3) design to resist frost heaving by accounting for adfreeze forces. Footing size may be determined after consideration of frozen ground characteristics: strength, creep, and settlement. Tools for predicting adfreeze frost heave and frost jacking loads are not as well developed as other design techniques. (Cassar-FRC)
W83-01931

OBSERVATIONS OF THE STABILITY OF THE VALLEY WALLS OF THE SULAK RIVER NEAR THE CHIRKEY HYDROELECTRIC STATION,
G. D. Kuroshev, and V. N. Vlasenko.
Hydrotechnical Construction, Vol 15, No 12, p 725-729, December, 1981. 3 Fig, 1 Ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No 12, p 11-13, December, 1981.

Descriptors: *Measuring instruments, *Geological formations, *Valleys, Rivers, Earthworks, Sulak River, Arch dams, Dams, Construction, *USSR, Chirkey Hydroelectric station.

Deformations of the walls individual stretches of the valley of the Sulak River were found during surveys and construction in the valley of the 236-m-high arch dam and powerhouse of the Chirkey hydrostation. Potentially unstable masses on the walls were detected from the displacements of points of the third-order triangulation network, which served as the main geodetic base of construction, and from the data of geological surveys. The deformations of the masses were determined by geodetic methods. Various geodetic surveys, instruments, and measurement methods were used, which made it possible to obtain quantitative characteristics of the deformations of the walls. Analyzing the results of the geodetic measurements yielded operative information about the reliability of the anchor support of the left-bank slope. One of the important processes involved in setting up observations of the stability of valley walls is the selection of the initial control points, whose stability should be checked periodically. The polar method with the use of the MSD-1 optical rangefinder showed itself to be a most progressive measurement method. Use of this method shortened the time of field measurements and office processing without loss of quality of the results obtained. (Baker-FRC)
W83-02085

THE DESIGN AND APPLICATION OF VERTICAL DRAINS,
A. Chalmers.
Civil Engineering (London), p 33, 34, 39, 40, September, 1982. 8 Fig.

Descriptors: *Drainage, *Vertical drains, *Design criteria, *Clays, Soil types, Soil characteristics, Soil properties.

The basic design approach for vertical drains is reviewed, with some of the more recent examples being considered in depth. When a clay soil is subjected to a load the equilibrium pore pressure is distributed, and the water in the voids between the clay particles tends to migrate, allowing the soil particles to be pressed together. One of the controlling geological factors in the rate of consolidation is the presence or lack in the clay soil of macro-sized features such as sand and silt layers, or laminations which can have a thickness of less than 1 mm. In the past 15 years some 50 vertical drain contracts have been carried out to consolidate clay soils under load. Various techniques have been used, including 150 to 600 mm diameter sand-drains, 65 mm diameter sandwicks, filter wrapped perforated plastic tubes, and band-drains. Over the past four years the latter technique has prevailed in soft ground conditions because of its economically proven effectiveness. Band-drains can also minimize construction time, since relatively high production rates are possible. Vertical drains are most frquently used for the purpose of accelerating the consolidation of soft compressible clays below embankments for highways, railways and airfields. (Baker-FRC)
W83-02094

8E. Rock Mechanics and Geology

ADDING A FIFTH UNIT TO IDAHO'S BROWNLEE DAM,
International Engineering Co., Inc., San Francisco, CA. Water Resources Div.
O. Hougen, and K. Runyan.
International Water Power and Dam Construction, Vol 34, No 7, p 15-18, July, 1982. 3 Fig.

Descriptors: *Intake gates, *Hydroelectric power, *Hydraulic turbines, Dams, Dam construction, Cooling water, Intakes, Electric powerplants, Rock mechanics, Turbines, Hydraulic design.

The fifth unit at the Idaho Power Company's Brownlee dam was installed in April 1980. A tunnel was built to convey water from the intake to the powerhouse. The intake structure had to be modified to handle a higher turbine discharge. Hydraulic analyses were carried out to see that operation of the fifth intake would not affect the hydraulic integrity of the forebay. Rock behavior was monitored during the construction and operation of the fifth unit to check and evaluate the stability of the excavation. There are no indications of excessive vibration or damage to the trashrack since the unit began operation. Flow conditions in the tailrace have been better than expected, and initial minor problems with the data acquisition system and the oil cooling system for the thrust bearing have been corrected. (Geiger-FRC)
W83-01846

8G. Materials

EVALUATION OF FILTER FABRICS FOR USE IN SILT FENCES,
For primary bibliographic entry see Field 5G.
W83-01830

GEOPHYSICAL LOGGING SUPPLEMENTS TELEVISION INSPECTIONS,
Water Research Centre, Marlow (England).
For primary bibliographic entry see Field 7B.
W83-01834

WATER SYSTEM REHABILITATION WAS A TIMELY INVESTMENT,
For primary bibliographic entry see Field 6B.
W83-01835

FILTER CRITERIA FOR GEOTEXTILE: RELEVANCE AND USE,
Lawson Consulting, Sydney (Australia).
For primary bibliographic entry see Field 8D.
W83-01930

FACTORS AFFECTING THE PERFORMANCE OF DRAINAGE ENVELOPE MATERIALS IN STRUCTURALLY UNSTABLE SOILS,
Rijksstation voor Landbouwtechniek, Merelbeke (Belgium).
W. Dierickx, and H. Yuncuoglu.
Agricultural Water Management, Vol 5, No 3, p 215-225, 1982. 7 Fig, 2 Tab, 2 Ref.

Descriptors: *Fibers, *Drainage envelopes, *Materials testing, Soil water, Coconut fibers, Polystyrene balls, Head loss.

Drainage envelope materials (coconut fibers, synthetic fibers with coarse pores, needled synthetic fibers with fine pores, and polystyrene balls in perforated polyethylene sheet) were subjected to flow tests in vertical columns filled with unstable non-cohesive silt loam soil. Upward flow and 100 m column height were found most suitable for experiments. Initial moisture content of the soil was an important factor in envelope material performance. Dry aggregates were unstable upon wetting, while at an initial moisture content of 15%, aggregates broke down at increasing hydraulic gradient. Most stable soil aggregates were at initial moisture contents of 17.5-20%, above which aggregates weakened and became more sensitive to compaction. No head losses were observed at 3% initial soil moisture in coarse-textured synthetic fibers or polystyrene balls or at 15% initial soil moisture in coconut fibers and coarse synthetic fibers. Slight head losses were seen at 3% initial soil moisture in coconut fibers and fine-textured synthetic fibers and at 15% in fine-textured synthetic fibers and polystyrene balls. The best envelope material for this particular soil was coarse-textured synthetic fibers. (Cassar-FRC)
W83-02018

WHAT TYPE SEWER PIPE IS BEST. LIFE-CYCLE COST ANALYSIS YIELDS ANSWER,
Camp, Dresser and McKee, Inc., New York.
T. Moss, and E. J. Jankiewicz.
Civil Engineering (New York), Vol 52, No 10, p 75-76, October, 1982. 1 Fig.

Descriptors: *Pipes, *Construction, *Cost analysis, Economic aspects, Pipelines, Conveyance structures, Plumbing, Concrete, Steel, Materials.

Sewer pipe is now selected on a life-cycle-cost basis in Winchester, Virginia. The pipe which is selected for use is the one which promises to save money over the long term. The key to this approach is to look at the long-term costs over the anticipated lifetime of a sanitary or storm sewer, not to look only at the initial costs. Using a present worth technique, a comparison is made of the costs that would result from using different pipe materials, figuring all costs over the lifetime of various pipes. Pipe life varies with the pipe material and the application to which it is put. The lifespan of each material changes from site to site. In each case one must consider the special circumstances, including soil acidity, resistivity, and water conditions. (Baker-FRC)
W83-02096

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

WATER QUALITY INVENTORY AND MONITORING PROGRAM FOR THE COMMONWEALTH OF VIRGINIA: STATE-OF-THE-ART,
Virginia Univ., Charlottesville. Dept. of Civil Engineering.
C. E. Parker.
Available from the National Technical Information Service, Springfield, VA 22161 as PB83-167528, Price codes: A03 in paper copy, A01 in microfiche. Virginia Water Resources Research Center Report, Virginia Polytechnic Institute and State University, Blacksburg, August 1982. 40 p, 1 Fig, 1 Tab, 2 append. OWRT A-098-VA(1).

Descriptors: Water quality, *Water resource information, Inventory, *Monitoring, *Data collection, Water quality data collection, *Information dissemination, *Data storage and retrieval, *Virginia, *Surveys, Texas.

A state-of-the-art survey of water quality inventory and monitoring programs in Virginia was made to establish the needs and sense of direction the Commonwealth should take concerning the collection and dissemination of water quality information. Inquiries outside the Commonwealth were made to satisfy the need to know what other state agencies and interstate commissions have done or are doing in the area of water quality information systems. Results indicate that a variety of data storage and retrieval systems have gained some use in the Commonwealth. Although each institutional and political entity has gone on its own to satisfy

some minimal need, the importance of a water resource information system with the ability to pull together information that can be accessed through one terminal or telephone call, is recognized. Most data information systems that have emerged in Virginia are the result of some cooperative effort with a federal agency. Commonwealth Data Base may be the beginning of a broad data information system that can become a part of a water resource data management system. It appears that Texas has established a system that can serve as a model for Virginia. The Texas Natural Resources Information System acts as a clearinghouse between state agencies. Part of its function is to catalogue and make accessible water resource information.
W83-01949

10F. Preparation Of Reviews

ATLAS OF THE SPAWNING AND NURSERY AREAS OF GREAT LAKES FISHES; VOLUME XIV, LITERATURE CITED,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
C. D. Goodyear, T. A. Edsall, D. M. O. Dempsey, G. D. Moss, and P. E. Polanski.
Report FWS/OBS-82/52, September 1982, 150 p, 2175 Ref. NCE-IS-78-30.

Descriptors: *Spawning, *Fish, *Aquatic habitats, *Distribution, *Bibliographies, *Great Lakes, Fish nursery, Fish eggs, Fisheries.

This bibliography lists the literature cited in Volumes I-XIII of this atlas of fish spawning and nursery areas. In the preparation of the atlas it was found that support (or supported) major recreational or commercial fisheries, or that are or were major components of the forage base; conversely, relatively little information was available for many other species not included in these general categories. (Moore-SRC)
W83-01884

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